IRON AND STEEL ENGINEER

Convention Issue

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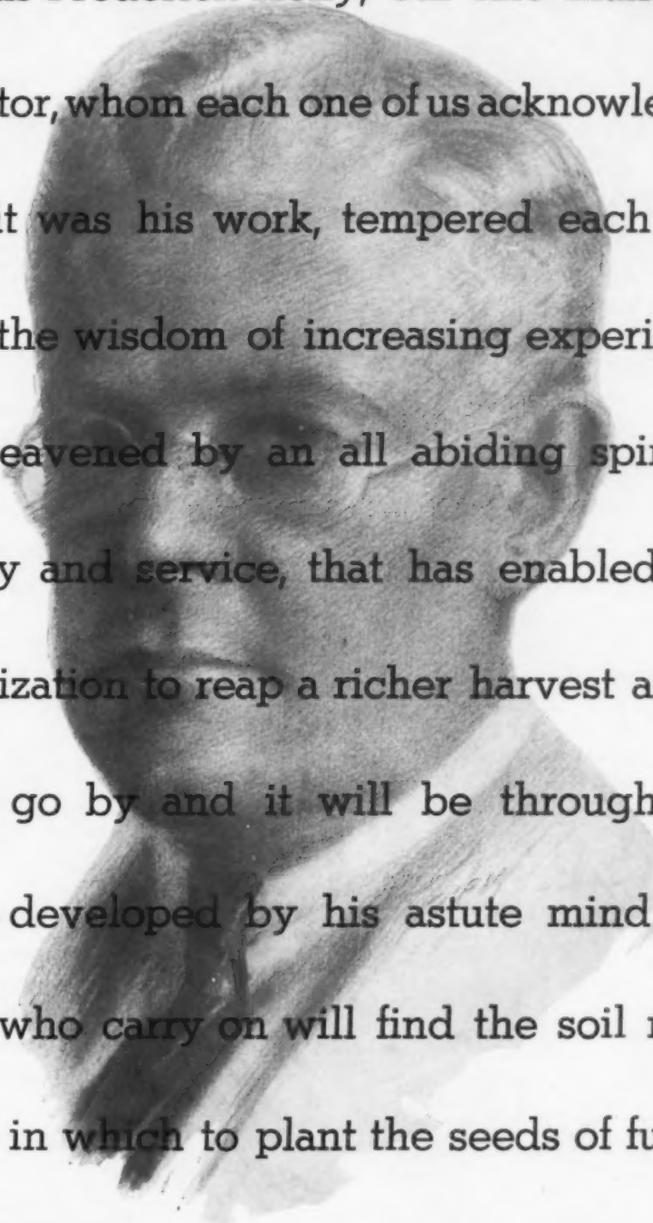
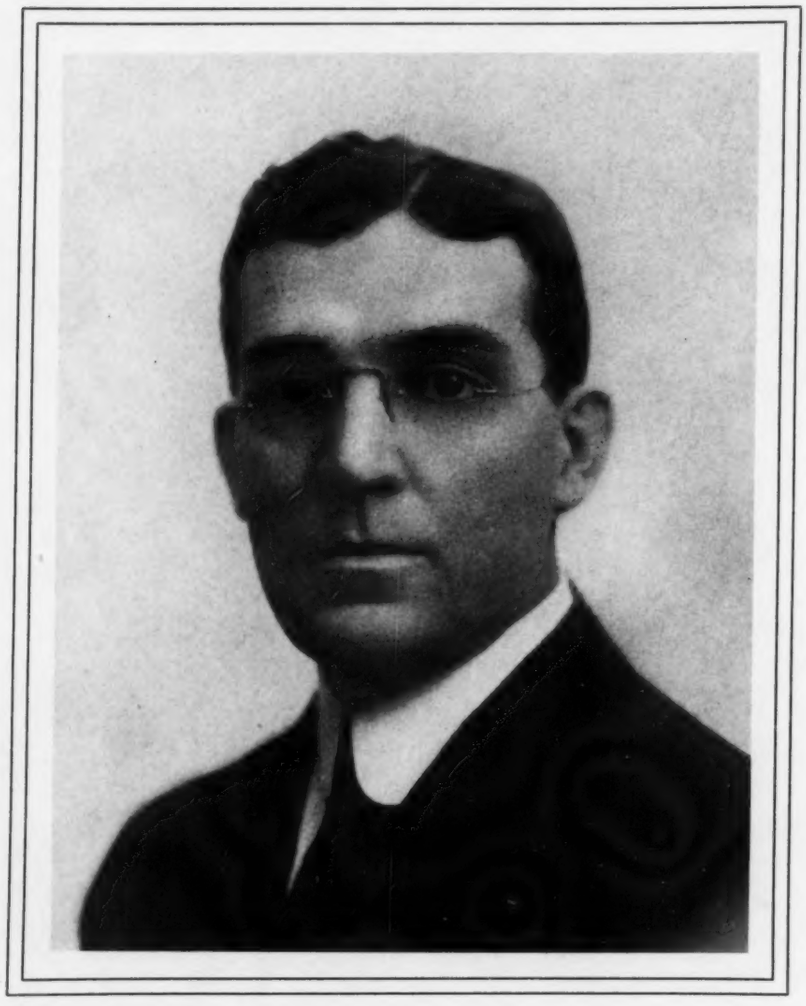


John Frederick Kelly, our late managing director, whom each one of us acknowledges that it was his work, tempered each year with the wisdom of increasing experience, and leavened by an all abiding spirit of loyalty and service, that has enabled this organization to reap a richer harvest as the years go by and it will be through the plans developed by his astute mind that those who carry on will find the soil more fertile in which to plant the seeds of future achievement.



C. W. BENNETT

C. W. Bennett, President of the American Sheet and Tin Plate Company, who will act as official host to our 31st Convention and Iron and Steel Exposition.

American Sheet and Tin Plate Company

SUBSIDIARY OF UNITED STATES STEEL CORPORATION

General Offices: Frick Building

Pittsburgh,

CHARLES W. BENNETT
PRESIDENT

September 1, 1935.

Association of Iron and Steel Electrical Engineers,
1010 Empire Building,
Pittsburgh, Pennsylvania.

Gentlemen:

Your Association's fine record of achievement in many years of service to the IRON AND STEEL INDUSTRY makes the privilege of welcoming your 31st ANNUAL CONVENTION to Pittsburgh most enjoyable. Over a considerable period of years my connection with the Industry and membership in your Association have afforded opportunity to observe the active, intelligent, direction of your varied activities, which have contributed so largely to technical progress in the Industry and improvement in our Country's social structure.

It seems particularly fitting to mark the important part taken in your Association's activities by your publication, "IRON AND STEEL ENGINEER". As a medium for the distribution of papers, discussions, and information on subjects of live interest, it is a welcome and helpful visitor to all recipients and especially so to those unable to regularly attend the Association's meetings.

It is observed that the subjects to be discussed at the coming convention September 24-25-26, 1935 cover a wide range of matters of direct concern to the Iron and Steel Industry and some that are now prominently before the public. "ABSORPTION OF THE PRODUCTS OF STRIP MILLS" and "INDUSTRIAL RELATIONS" are topics indicative of the desire and intent of your organization to render a maximum of service to society as a whole.

In the present disturbed condition of industry and the uncertain trend of relations between BUSINESS and GOVERNMENT, it is heartening and reassuring that your energies continue to be ably directed to improvement in technical methods and processes, to utilization of these to the utmost in lightening the labor of mankind, and to consideration of equitable distribution of the fruits of technical development. Representing, as your Membership does, all sections of our great Country, your organization is well qualified to consider the many problems - technical, social, political - arising in connection with and largely as a direct result of Engineering Developments of recent years.

It is, therefore, with high appreciation of past accomplishments and in confidence of your ability to solve new problems that Pittsburgh again welcomes you.

Yours very truly,

C W Bennett

President.

Official Program

31ST CONVENTION AND IRON AND STEEL EXPOSITION

WILLIAM PENN HOTEL - PITTSBURGH, PA.

SEPTEMBER 24, 25, 26, 1935

TUESDAY, SEPTEMBER 24TH.

CHAIRMAN
C. A. THAYER, Chief Engineer, Republic Steel Corporation, Youngstown, Ohio.

VICE CHAIRMAN
STANLEY GRAND-GIRARD, Mechanical and Electrical Supt., Sharon Steel Hoop Company, Sharon, Penna.

9:00 A.M. Registration, Lobby, William Penn Hotel.

Italian Room, Lobby, William Penn Hotel

CHAIRMAN
G. R. CARROLL, Electrical Supt., Jones and Laughlin Steel Corp., Aliquippa, Penna.

VICE CHAIRMAN
J. L. MILLER, Asst. Chief Engineer, Carnegie Steel Company, Youngstown, Ohio.

9:30 A.M.

"DEVELOPMENTS IN THE IRON AND STEEL INDUSTRY 1934-1935" by W. H. Burr, Electrical and Mechanical Superintendent, Lukens Steel Company, Coatesville, Penna.

10:00 A.M.

"A REVIEW OF SHEET, TIN AND STRIP MILLS" by Stephen Badlam, Consulting Engineer, Pittsburgh, Pa.

10:45 A.M.

"ROLL TABLE EQUIPMENT FOR WIDE STRIP MILLS" by G. A. Caldwell and S. F. Henderson, Westinghouse Elec. & Mfg. Company, East Pittsburgh, Penna.

11:15 A.M.

"INDIVIDUAL DRIVES FOR RUNOUT TABLE AND COILER ROLLS" by L. E. Hildebrand, Motor Engineering Department, General Electric Company, Lynn, Mass., and W. B. Snyder, Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

1:15 P.M.

Main Ball Room, 17th Floor, William Penn Hotel

CHAIRMAN
CHARLES R. HOOK, President, American Rolling Mill Company, Middletown, Ohio.

VICE CHAIRMAN
J. A. VOSS, Manager of Industrial Relations, Republic Steel Corporation, Youngstown, Ohio.

"INDUSTRIAL RELATIONS" by Arthur H. Young, Vice President, United States Steel Corporation, New York, N. Y.

2:15 P.M.

CHAIRMAN
T. E. HUGHES, Superintendent of Maintenance, Carnegie Steel Company, Duquesne, Penna.

VICE CHAIRMAN
W. E. MILLER, Elec. & Mech. Superintendent, Bethlehem Steel Company, Johnstown, Pa.

"MATERIAL HANDLING IN THE IRON AND STEEL INDUSTRY" by G. N. Harmon, Electrical Superintendent, Republic Steel Corporation, Warren District, Warren, Ohio.

4:00 P.M.

IRON AND STEEL EXPOSITION VISIT by National Officers, National Engineering Committees, Membership and Guests.

10:00 P.M.

Main Ball Room, 17th Floor, William Penn Hotel

CHAIRMAN
D. I. BOHN, Electrical Engineer, Aluminum Company of America, Pittsburgh, Pa.

VICE CHAIRMAN
J. W. BATES, Electrical Engineer, American Sheet and Tin Plate Co. Pittsburgh, Pa.

EXHIBITORS INFORMAL DANCE, Ball Room, William Penn Hotel, Pittsburgh, Pa.

WEDNESDAY, SEPTEMBER 25TH, 1935.

Italian Room, Lobby, William Penn Hotel

9:15 A.M.

CHAIRMAN
F. E. FLYNN, Assistant District Manager, Warren District, Republic Steel Corporation, Warren, Ohio.

VICE CHAIRMAN
R. S. SHOEMAKER, Superintendent, Blooming, Bar and Strip Mills, American Rolling Mill Company, Middletown, Ohio.

"PROCESSING OF STEEL IN THE FINISHING DEPARTMENTS" by R. J. Wean, President, Wean Engineering Company, Inc., Warren, Ohio.

9:45 A.M.

"THE FLAT ROLLING OF STEEL" by C. L. McGranahan, Superintendent 76" Hot Strip Mill, Inland Steel Company, Indiana Harbor, Indiana.

10:45 A.M.

"THE MANUFACTURE AND USE OF IRON AND STEEL ROLLS" by S. H. Griffiths, and J. L. Campbell, Ohio Steel Foundry Company, Lima, Ohio.

11:15 A.M.

"LUBRICANTS FOR COLD ROLLING STRIP STEEL" by Dr. R. W. Moore, Physicist, and E. S. Reynolds, Sales Engineer, Socony Vacuum Oil Company, New York, N. Y.

1:15 P.M. (D.S.T.)

INSPECTION TRIP, WEIRTON STEEL COMPANY, Weirton, W. Va. Special Train which the A.I. & S.E.E. will provide and the guests must use, will leave Pennsylvania Railroad, Fourth Ave. Station, Try St. Yards, Pittsburgh, Pa., at 1:15 P.M. (D.S.T.) Price $2.50 per person.

THURSDAY, SEPTEMBER 26TH, 1935.

Combustion Engineering Division
Cardinal Room, 17th Floor, William Penn Hotel

CHAIRMAN
J. A. CARTER, General Supt.
Sharon Steel Hoop Company,
Lowellville, Ohio.

VICE CHAIRMAN
T. J. ESS, Combustion Engineer,
Republic Steel Corporation,
Massillon, Ohio.

9:30 A.M.

"FACTORS TO BE CONSIDERED IN THE INSULATION OF OPEN HEARTH FURNACES" by Gilbert Soler, Manager of Research, Timken Steel and Tube Company, Canton, Ohio.

10:00 A.M.

"THE VENTURI PORT" by George L. Danforth, Jr., President, Open Hearth Combustion Company, Chicago, Ill.

10:30 A.M.

"THE POURING OF MOLTEN STEEL" by J. P. Walters, Open Hearth Superintendent, and Dr. E. G. Hill, Director of Research, Lukens Steel Company, Coatesville, Penna.

11:15 A.M.

"ROOF TEMPERATURE CONTROL OF OPEN HEARTH FURNACES" by M. J. Bradley, Engineer, Leeds and Northrup Company, Philadelphia, Penna.

2:00 P. M.

"RADIANT HEAT TRANSMISSION WITH LOW DRAFT IN OPEN HEARTH FURNACE OPERATION—4,000,000 B.T.U. PER TON—WISCONSIN STEEL WORKS" by E. H. Schwartz, Superintendent of the Open Hearth Department and George E. Rose, General Superintendent, Wisconsin Steel Works, International Harvester Company, South Chicago, Ill.

2:30 P.M.

CHAIRMAN
MARTIN J. CONWAY, Fuel Eng.,
Lukens Steel Company,
Coatesville, Penna.

VICE CHAIRMAN
W. N. FLANAGAN, Special Eng.,
Carnegie Steel Company,
Pittsburgh, Penna.

"SOME APPLICATIONS OF CONTROLLED ATMOSPHERE TO HEATING OF STEEL" by T. B. Bechtel, Engineer, Electric Furnace Company, Salem, Ohio.

3:00 P.M.

"RECENT DEVELOPMENTS IN BRIGHT ANNEALING OF SHEETS AND STRIP IN ELECTRIC FURNACES" by A. N. Otis, Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

3:30 P.M.

"A NOVEL TYPE OF HIGH TEMPERATURE CONVEYOR" by W. E. Blythe, District Manager, Driver-Harris Company, Detroit, Michigan.

Mechanical and Lubrication Engineering Divisions,
Blue Room, 17th Floor, William Penn Hotel

9:15 A.M.

CHAIRMAN
C. C. PECU, Lubrication Eng.,
Bethlehem Steel Company,
Lackawanna, New York.

VICE CHAIRMAN
C. J. KLEIN, Chief Engineer,
Weirton Steel Company,
Weirton, W. Va.

"COMPOSITION BEARINGS FOR ROLL NECKS AND OTHER PURPOSES" by H. M. Richardson, Application Engineer Plastics Department, General Electric Company, Lynn, Mass.

9:30 A.M.

"PROGRESS IN THE USE OF COMPOSITION BEARINGS" by K. T. MacGill, Manager, Glyco-Ryertex Division, Joseph T. Ryerson & Son, Inc., Chicago, Ill.

9:45 A.M.

"LAMINATED STEEL MILL BEARINGS" by H. F. Horn, Micarta Products Department, Westinghouse Electric & Mfg. Company, Trafford, Penna.

10:15 A.M.

"OIL BEARINGS FOR ROLL NECKS" by J. H. Hitchcock, Engineer, Morgan Construction Company, Worcester, Mass.

10:45 A.M.

"THE DEVELOPMENT OF SPECIFICATIONS FOR LUBRICANTS" by O. L. Maag, Lubrication Engineer, Timken Roller Bearing Company, Canton, Ohio.

11:15 A.M.

"CUTTING FLUIDS—THEIR RELATION TO STEEL AND THE STEEL MILL" by W. H. Oldacre, Director of Research, D. A. Stuart & Company, Ltd., Chicago, Ill.

1:15 P.M.

Main Ball Room, 17th Floor, William Penn Hotel

CHAIRMAN
NORBERT J. CLARKE, Vice Pres.,
Republic Steel Corporation,
Youngstown, Ohio.

VICE CHAIRMAN
MYRON S. CURTIS, Sales Pr. Mgr.
Youngstown Sheet & Tube Co.,
Youngstown, Ohio.

"ABSORPTION OF STEEL IN FEDERAL PROJECTS" by Colonel Horatio B. Hackett, Assistant Administrator, Public Works Administration, Department of the Interior, Washington, D. C.

Welding Engineering Division,
Main Ball Room, 17th Floor, William Penn Hotel

2:00 P.M.

CHAIRMAN
WRAY DUDLEY, Electrical Eng.,
National Tube Company,
Pittsburgh, Penna.

VICE CHAIRMAN
J. D. DONOVAN,
Electrical & Mechanical Supt.
Republic Steel Corporation,
Massillon, Ohio.

"DEVELOPMENTS IN WELDING IN 1934-35" by Grover A. Hughes, Electrical Engineer, Truscon Steel Company, Youngstown, Ohio.

2:20 P.M.

"ALTERNATING CURRENT ARC WELDING" by W. W. Reddie, Industrial Department, Westinghouse Elec. & Mfg. Company, East Pittsburgh, Pa., and E. Steinert, Transformer Engineering Department, Westinghouse Elec. & Mfg. Company, Sharon, Penna.

2:40 P.M.

"WELDING AND THE STEEL INDUSTRY" by E. W. P. Smith, Consulting Engineer, Lincoln Electric Company, Cleveland, Ohio.

3:00 P.M.

"WELDING WITH THE ALTERNATING CURRENT ARC" by H. A. Winne, Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

3:20 P.M.

"DEVELOPMENTS IN THE USE OF THE OXY-ACETYLENE PROCESS IN THE IRON AND STEEL INDUSTRY" by E. J. W. Egger, Resident Engineer, Linde Air Products Company, Pittsburgh, Penna.

10:00 P.M.

Main Ball Room, 17th Floor, William Penn Hotel

FORMAL RECEPTION.

CHAIRMAN
G. R. CARROLL, Electrical Supt.,
Jones and Laughlin Steel Corp.,
Aliquippa, Penna.

VICE CHAIRMAN
J. A. MORGAN, Assistant Supt.,
Maintenance Department,
Carnegie Steel Company,
Braddock, Penna.

1935 Iron & Steel Exposition

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Youngstown Sheet & Tube Co. Exhibit Model	Hall No. 2 Annex

Important Note—Booth Nos. 1 to 51 incl. are located in Hall No. 1.

Booth Nos. 52 to 99 incl. are located in Hall No. 2.

Booths marked A, B, C, D, E are located in room off Hall No. 1.

Booth Nos. C-100 to C-106 incl. are located in Main Corridor.

Booths Nos. A-1 to A-11 incl. are located in Annex off Hall No. 2 and adjacent to exhibit model of Y. S. & T. Co. No. 2.

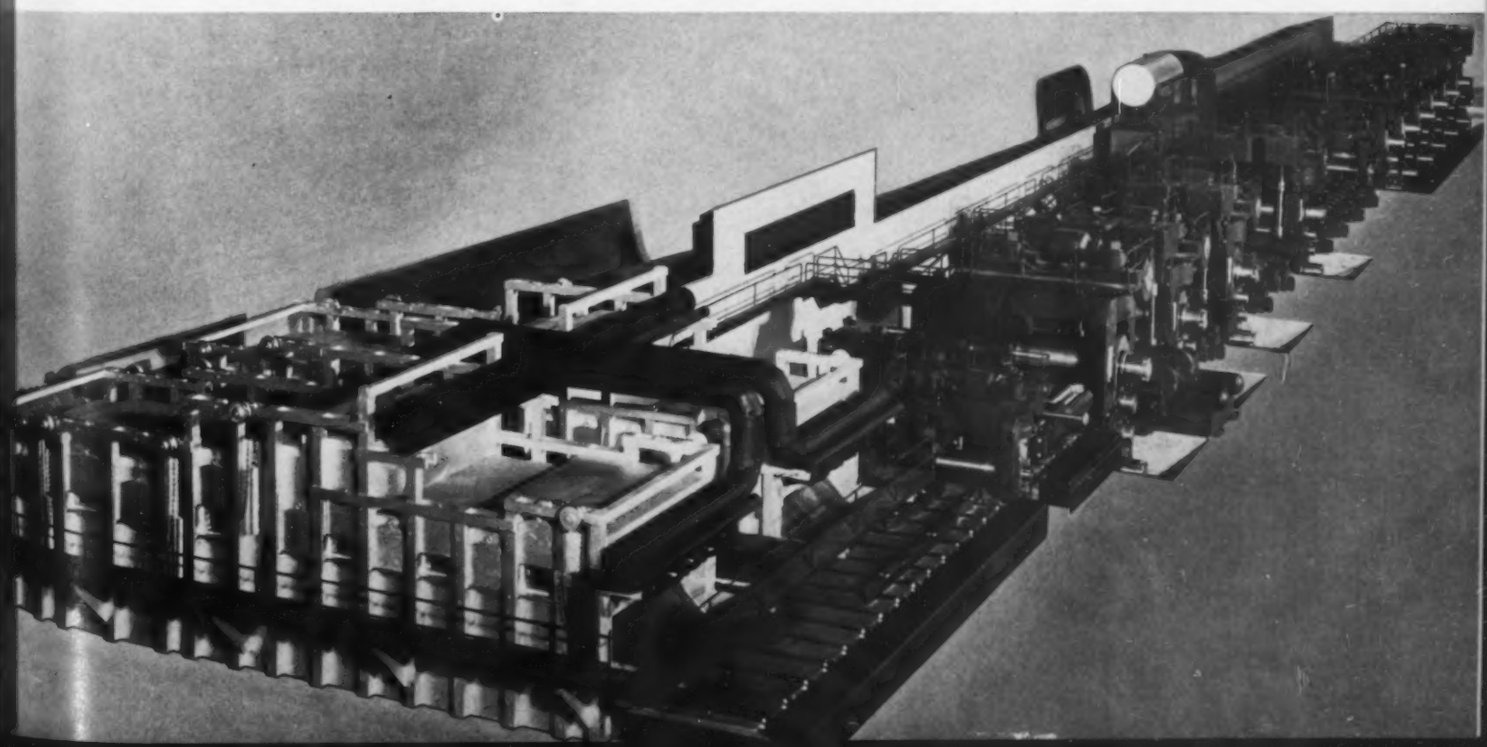
Additions to this List will be made later.

Iron and Steel
EXPOSITION

As shown on the opposite page over 100 manufacturers of steel mill equipment have reserved space in the Iron and Steel Exposition which will be held in conjunction with the annual convention, September 24, 25 and 26.

Utilizing both exhibition halls of the William Penn Hotel, this display of steel mill machinery promises to be one of the most interesting held in years. With manufacturers serving the industry making every effort to develop equipment to aid the steel manufacturer in turning out a quality product, the exhibits, many in actual operation, should prove to be of great educational value to the engineers and executives attending the conference.

One of the Outstanding Displays of the Exposition— Youngstown Sheet and Tube Company's Miniature Hot Strip Mill.



G. R. CARROLL

President, Association of Iron and Steel
Electrical Engineers for 1935-1936

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Chicago, Ill.

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General Supt., Jones & Laughlin Steel Corp.,
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President, Sharon Steel Hoop Company,
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H. J. Fisher
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H. Lynn
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G. W. First
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A. C. Dyer
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V. J. Nolan
G. L. Stout

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J. J. Bangert
L. F. Worden
J. D. Reed
J. K. Keogh

T. S. Towle
B. J. Ballard
S. R. Cox, Jr.
W. Anderson
H. D. Robb

THURSDAY EVENING—FORMAL RECEPTION

G. R. Carroll, Chairman J. A. Morgan, Vice Chairman

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J. A. Clauss
S. Grand-Girard
W. H. Burr
C. C. Wales

F. D. Egan
C. H. Hunt
F. W. Cramer
C. C. Pecu
C. A. Kral

W. E. Miller
E. Friedlander
J. Farrington
J. L. Miller
J. D. Donovan

L. F. Coffin
M. J. Conway
C. J. Smith
C. R. Tinsley
J. A. Voss

Steel Executives Participating in Convention

I. LAMONT HUGHES, President
Carnegie Steel Company

W. A. IRVIN, President
United States Steel Corp.

W. B. GILLIES, Vice-President
Youngstown Sheet & Tube Co.

J. E. MONTGOMERY, Vice-President
Otis Steel Company

L. E. BLOCK, Chairman of the Board
Inland Steel Company

F. E. FIEGER, Vice-President
Jones & Laughlin Steel Corporation

Steel Executives Participating in Convention

G. C. KIMBALL, Vice-President
Illinois Steel Company

W. C. SUTHERLAND, Vice-President
Pittsburgh Steel Company

N. C. HARRISON, Vice-President
Atlantic Steel Company

J. E. LOSE, Vice-President
Carnegie Steel Company

W. F. DETWILER, Exec. Vice-President
Allegheny Steel Company

R. W. WOLCOTT, President
Lukens Steel Company

A. N. DIEHL, President
Columbia Steel Company

J. G. WEST, Jr. Asst. Gen. Manager
Jones & Laughlin Steel Corp.

Steel Executives Participating in Convention

C. F. BLACKMER, President
American Steel & Wire Company

HENRY ROEMER, President
Sharon Steel Hoop Company

F. J. GRIFFITHS, President
Timken Steel & Tube Company

C. R. BARTON, Vice-President
Spang-Chalfant & Co., Inc.

HARRY HOLIDAY, Works Mgr.
American Rolling Mill Company

F. E. FLYNN, Asst. Gen. Manager
Republic Steel Corporation

KARL LANDGREBE, Vice-President
Tennessee Coal, Iron & R. R. Co.

R. H. WATSON, Vice-President
U. S. Steel Corporation

INDUSTRIAL RELATIONS
—THE ASSOCIATION'S INFLUENCE

By ERNEST TENER WEIR

Chairman of the Board, National Steel Corporation, Pittsburgh, Pa.

▲ THE FIRST CONCERN of any industrial organization must be its continuing ability to turn out a good product at low cost. This is accomplished only where peace and good will mark the internal affairs of a plant, where labor and management has confidence in each other and are free to concentrate upon their respective jobs . . . . in short, where a condition of good industrial relations prevails.

Industrial relations always have been an important part of the whole industrial picture, but it is relatively only a short time in which these relations have been recognized as a separate function of industry worthy of the conscious, planned attention that is accorded to production and selling. The reason probably was that in former times, plant units were small. Management executives were in daily personal contact with workmen. They knew them by name, knew their characteristics, knew something of their personal problems, knew intimately the details of their various jobs.

The situation changed with the development of large-scale production. Plants were greatly expanded, the number of employees multiplied, the spread between ranking executives and workmen widened, and the jobs of both became more highly specialized. As was inevitable, these conditions injected an impersonal note into industry, and created the need for an entirely new technique in the relationships between labor and management. This technique has developed, or rather is developing, and is recognized in the distinct and indispensable field of industrial relations.

Nowhere are labor relations more important than they are in the steel industry. This is true because of the great number of persons directly and indirectly dependent upon it, and also because, through the basic nature of its product, it vitally affects every other industry. For these reasons, the steel industry bears a double responsibility to set a standard in labor relations.

It would be difficult to overestimate the measure of influence that can be exerted upon the preservation and advancement of good internal conditions by the type of men who make up the membership of the Iron and Steel Electrical Engineers Association. I realize that this membership is not limited to electrical engineers, despite the name, but is represented in maintenance and operating departments throughout the industry. Such a group of men—occupying key positions, coming into close, daily contact with the vast majority of workmen, and having the technical training and background which enables them to observe and to interpret—holds a vantage-point which probably affords the finest opportunity in the industry to study and to aid in the improvement of the conditions under which steel is made.

Your Association deserves great credit for the work that already has been accomplished in this direction. The achievement of establishing the National Safety Council, alone, was a praiseworthy contribution toward eliminating and minimizing the hazards to life and limb in the making of steel, and anyone whose memory stretches back to 1912, when the Council was founded, can readily visualize the strides that have been made. The consistent examination into and conference on these problems, which is provided for in the Association's program, assures the continuance of that progress.

Matters of safety, and working conditions in general, are of such high importance in the whole problem of industrial relations that it is safe to say that no plant could neglect them and, at the same time, build an enduring success. The humanitarian angle is apparent. Normal human feeling dictates that no employee be required to work under conditions that expose him to preventable injury, that affect his health adversely, nor even that cause him unnecessary discomfort. But economic considerations, alone, not only justify but also demand that everything possible be done to raise standards of safety and working conditions. Anyone with practical experience knows that a plant with a high-frequency accident rate is a high-cost plant, and it has been demonstrated time and again that improvement in working conditions is attended with a proportionate increase in efficiency.

Perhaps the most important result of work of this kind is its effect upon the attitude of labor. To the workman, there can be more direct proof that his employer knows he has a name as well as a check-number than the constant vigilance and effort of management to make his work easier, safer, and more comfortable. The genuine concern of an employer for the safety and welfare of his employees is reciprocated by the workman with an attitude toward his work and a loyalty toward his company that is of highly practical value.

Today, the opportunity for good work along these lines is greater than ever. With the Employee Plan of Representation practically general throughout the

ERNEST TENER WEIR

steel industry, we have a completely effective medium for the location and improvement of safety and working conditions on the initiative of either workmen or executives. Of course, the scope of employee plans is not confined to welfare matters, but embraces the full range of employer-employee relationships. It hurdles many of the obstacles that formerly stood in the path of good industrial relations, and has wiped out many sore spots in the industry. It has minimized the number of grounds on which the interests of employees and employers were opposed by effecting satisfactory adjustments, and has strengthened the mutual interests which bind employee and employer together in the great common purpose of making their plant a "going concern." The Employee Plan is the most important recent development in industrial relations and I consider it the solution of the problem of management in labor relationships. As such, it is worthy of the deep interest and the support of everyone in the industry, and particularly of the type of men numbered in your Association.

As with all American life, the history of the steel industry has been a record of constant change. Practices and equipment have become obsolete as soon as something better developed. This is as it should be, because it is this ceaseless search for quicker, easier, more economical ways of doing things that has won for the United States, the highest general standard of living in the world. There is no reason why industry should not apply the same approach to its human problems as it does to its technical problems. Your Association has amply demonstrated its ability to play a significant part in this phase of industrial life. The extension of your efforts, as an Association, upon an even broader basis, combined with the alertness to these problems of individual members and the use of opportunities that come to them in the course of their daily work will be marked with an improvement in industrial relations that will be comparable to the material progress of industry.

I wish to take this opportunity to congratulate the Association as it marks off another milestone of worthwhile accomplishment on the occasion of its thirty-first annual meeting, and to extend a personal welcome to the members who will visit the Weirton Steel Company plant during the convention.

Operating Officials Attending Convention

T. E. HUGHES, Chief Maint. Engr.
Carnegie Steel Company
Duquesne, Pa.

C. A. THAYER, Chief Engr.
Republic Steel Corporation
Youngstown, Ohio

F. D. EGAN, Elec. Superintendent
Bethlehem Steel Company
Lackawanna, New York

C. A. KRAL, Ass't. Gen. Mgr.
Wheeling Steel Corp.
Steubenville, Ohio

C. C. PECU, Lubrication Engineer
Bethlehem Steel Company
Lackawanna, N. Y.

W. S. HALL, Ass't. Gen. Supt.
Illinois Steel Company
South Chicago, Ill.

Operating Officials Attending Convention

J. D. DONOVAN, Elec. & Mech. Supt.
Republic Steel Corporation
Massillon, Ohio

J. W. BATES, Electrical Engr.
American Sheet & Tin Plate Co.
Pittsburgh, Pa.

W. H. WARREN, Gen. Manager
Wheeling Steel Corporation
Steubenville, Ohio

T. J. ESS, Combustion Engineer
Republic Steel Corporation
Massillon, Ohio

H. G. R. BENNETT, Ass't. Gen. Superintendent
Carnegie Steel Company
Duquesne, Pa.

E. J. KULAS, President
THE OTIS STEEL CO.

Economic Importance of G
and Iron & Steel E

▲ ONE OF THE MOST IMPORTANT events in the iron and steel world each year is the fall convention of the Association of Iron and Steel Electrical Engineers. This year it will be held in Pittsburgh from September 24th to 26th.

Meetings of this sort are of great value to the executives and engineers in our industry. Obviously, no single man or organization can successfully solve all of the problems that confront us. The interchange of ideas and practices which constitute such a vital part of these meetings is, therefore, of very real and lasting worth.

This is especially true at this time, for during recent months and years immense progress has been made in production methods with which all of us should be familiar.

Because of these facts the coming convention should establish an attendance record that will stand for a long time to come. Every technician, interested in his own and his company's progress should be on hand.

E. J. Kulas

nce of A. I. & S. E. E. Convention
Steel Exposition

T. M. GIRDLER, Chairman of the Board and President
REPUBLIC STEEL CORPORATION

▲ ONE OF THE MOST SERIOUS problems which faces the steel industry these days is how to keep operating efficiency at a pace with advances in research, sales and markets.

Research is constantly developing new special steels for new fields and uses. Our salesmen and our advertising are constantly spreading the acceptance and adoption of new steels.

As new steels and new uses of steels multiply, production must be adjusted to meet accurately a constantly wider range of specifications. At the same time quality must be maintained, and costs cut to a place which will assure sales at a profit.

This means that the operating side of the industry cannot afford to remain static for a minute. It must be up on its toes, alert to all the trends in the trade, constantly utilizing the utmost in engineering ingenuity and skill.

For this reason particularly, I regard the annual convention of the Association of Iron and Steel Electrical Engineers as a meeting of extraordinary importance. The wide range of subjects discussed and the varying viewpoints expressed are extremely valuable. This year's program is especially comprehensive.

There never was a time in the history of the steel industry when there were so many new developments under way as there are today. In my opinion, the forthcoming convention will prove to be one of the most interesting and profitable in the history of the Association.

T. M. Girdler

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American Sheet & Tin Plate Co.

J. H. McELHINNEY, Gen. Superintendent
Lukens Steel Company

W. SYKES, Asst. to the President
Inland Steel Company

G. E. ROSE, Gen. Superintendent
Wisconsin Steel Works

S. S. MARSHALL, JR., Gen. Superintendent
Jones & Laughlin Steel Corp.

J. M. HUGHES, Vice-President
Sharon Steel Hoop Company

Officials Participating in 31st Convention

F. F. SLICK, Gen. Supt.
Carnegie Steel Co.
Braddock, Pa.

R. S. SHOEMAKER, Rolling Mill Supt.
American Rolling Mill Co.
Middletown, Ohio

HARRY SAXER, Gen. Supt.
Jones & Laughlin Steel Corp.
Aliquippa, Pa.

A. C. CUMMINS, Gen. Supt.
Carnegie Steel Co.
Duquesne, Pa.

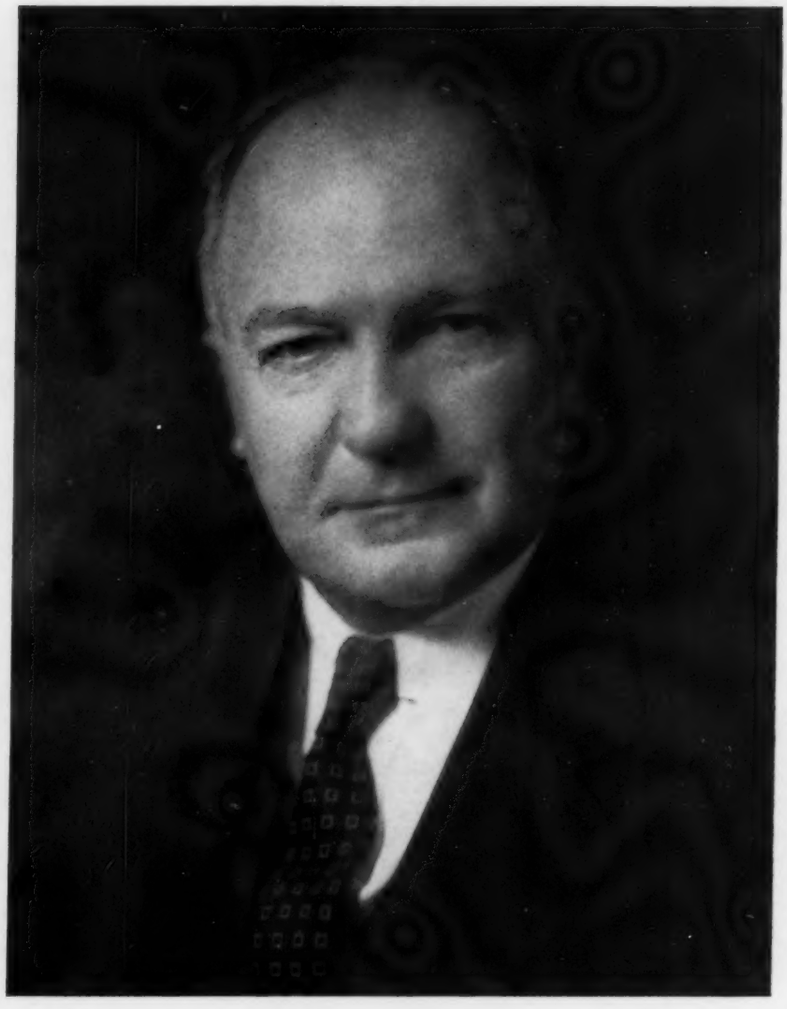
J. A. CLAUSS, Chief Engr.
Great Lakes Steel Corp.
Ecorse, Michigan

J. Z. COLLIER, Ass't. Gen. Mgr.
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

ARTHUR H. YOUNG

Vice-President, United States Steel Corporation

Mr. Young will address the society upon the subject of "Industrial Relations in the Steel Industry."



KNOWING WELL the measure of influence that can be exerted upon the preservation and advancement of good internal conditions in the steel industry by our membership, Mr. Arthur H. Young, Vice President, In Charge of Industrial Relations, United States Steel Corporation, has been secured to address the membership of the Society at the annual Convention. This talk will be given September 24th, at 1:15 P.M.

An idea of the well rooted background of Mr. Young with respect to the field of industrial relations can be gleaned from this following biographical sketch.

From 1905 to 1917 Mr. Young was with the Illinois Steel Company, and left that organization to become the director of the American Museum of Safety and serve as the government's chief safety expert during the war. For the six years after July, 1919 Mr. Young was manager of industrial relations at the International Harvester Company, Chicago. He was a co-author of the Harvester Industrial Council Plan and was responsible for the administration of this significant development in employee representation. In July 1924, Mr. Young became industrial relations counsel for the law firm of Curtis, Fosdick and Belknap, New York. The industrial relations staff of the firm was reorganized as Industrial Relations Counselors, Inc., in May, 1926, and Mr. Young was appointed secretary of that organization. On February 1, 1934, Mr. Young was elected Vice President, In Charge of Industrial Relations, of the United States Steel Corporation.

Mr. Young recently was awarded the Henry Lawrence Gantt medal in recognition of his meritorious work in the field of industrial relations by the Institute of Management.

CHARLES R. HOOK

President, American Rolling Mill Company

Mr. Hook will preside as chairman of the meeting featuring Mr. Young.

▲

IN KEEPING with the importance of the session at which Mr. A. H. Young will talk, Mr. Charles R. Hook, President and General Manager, American Rolling Mill Company, Middletown, Ohio, will preside as Chairman.

Mr. Hook, a graduate of Walnut Hills High School of Cincinnati, Ohio, secured his first job after his graduation in 1898 as office boy with the Cincinnati Rolling Mill and Tin Plate Company. On January 1899, The American Tin Plate Company (The Tin Plate Trust) took over the Cincinnati Rolling Mill and Tin Plate Company, and in December of that year Mr. Hook was transferred to the main Chicago Office as clerk, where he remained until the offices were moved to New York. He remained in the New York office as a clerk until April, 1900. At that time Mr. Hook was desirous of procuring some mill training, and he was transferred to Gas City, Indiana, at the Morewood Works of the Trust. He worked at that place until November 1, 1902. When he left there he was Assistant to the Superintendent. He next associated himself with The American Rolling Mill Company at Middletown, Ohio, as night superintendent, and has been with that corporation ever since. Since joining the American Rolling Mill Company, he has gone through the various departments as follows: Assistant General Superintendent, General Superintendent, Operating Vice President, Vice President and Assistant General Manager, Vice President and General Manager, which office he assumed July 1, 1920, and on January 7, 1930, he was elected President and General Manager.

He is a member of the Board of Directors of the American Iron & Steel Institute, the National Industrial Conference Board, and the National Association of Manufacturers, which organization he is Chairman of the Finance Committee. He represented the Iron and Steel Industry on the Durable Goods Industries Committee, which was elected by the Code Authorities, and made its report to President Roosevelt on May 14, 1934, covering the National Recovery program.

Operating Officials Attending Convention

C. J. KLEIN, Chief Engineer
Weirton Steel Co.
Weirton, W. Va.

L. F. COFFIN, Supt. Mech. Dept.
Bethlethem Steel Co.
Sparrows Point, Md.

JAMES FARRINGTON, Elec. Supt.
Wheeling Steel Corp.
Steubenville, Ohio

W. E. MILLER, Elec. & Mech. Supt.
Bethlehem Steel Co.
Johnstown, Pa.

C. R. TINSLEY, Elec. & Mech. Supt.
U. S. Pipe & Foundry Co.
Bessemer, Pa.

C. J. SMITH, Supt. Aux. Depts
Illinois Steel Company
South Chicago, Ill.

Operating Officials Attending Convention

F. W. CRAMER, Supt. Elect. Const.
Republic Steel Corp.
Youngstown, Ohio

D. I. BOHN, Electrical Engr.
Aluminum Co. of America
Pittsburgh, Pa.

W. N. FLANAGAN, Special Engr.
Carnegie Steel Co.
Pittsburgh, Pa.

J. L. MILLER, Asst. Chief Engr.
Carnegie Steel Company
Youngstown, Ohio

G. N. HARMON, Electrical Supt.
Republic Steel Corporation
Warren, Ohio

WRAY DUDLEY, Electrical Engr.
National Tube Company
Pittsburgh, Pa.

J. A. CARTER, General Supt.
Sharon Steel Hoop Co.
Lowellville, Ohio

THE ABSORPTION OF STEEL
IN FEDERAL AND OTHER PROJECTS

By Col. H. B. HACKETT, Asst. Public Works Administrator
Public Works Administration
WASHINGTON, D. C.

▲ WITH 3,500,000 tons of steel, having approximate value of $150,000,000, already absorbed by projects being financed by the Public Works Administration, every steel official and executive will be keenly interested in the speech to be made by Colonel H. B. Hackett, Assistant Administrator, P.W.A. at our Convention September 26th, in which he will outline the benefits the steel industry will receive through the many projects planned and under way at the present time.

From figures released by the Bureau of Labor Statistics, Department of Labor, it is estimated that up until July 1, approximately $1,000,000,000 worth of materials has been ordered from many industries for P.W.A. projects. Much of the steel purchased has been for railroad rails, structural shapes for immense bridges, such as the Triborough Bridge in New York, hundreds of public buildings, materials for thousands of new freight and passenger cars, the traffic tunnel now driving under the Hudson River and many other types of structures.

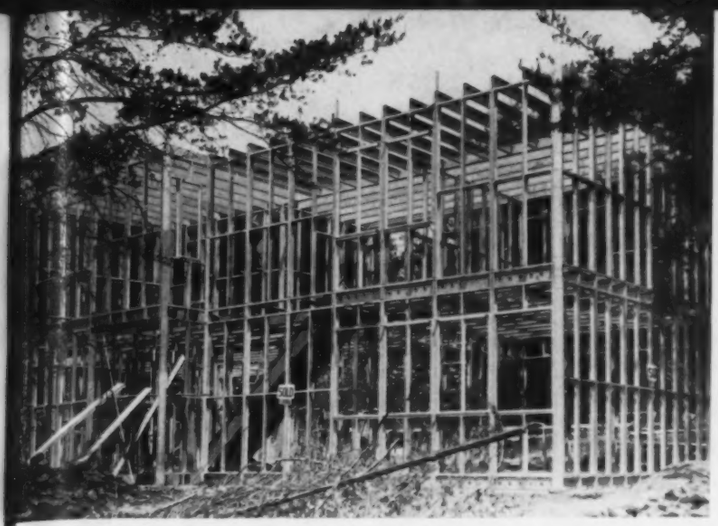
At the time for presentation of Colonel Hackett's address, he will have just concluded an extensive tour of the country and will be in a position to discuss many of the new undertakings being financed by the $4,800,000,000 recently granted the Public Works Administration.

Besides an intimate and broad knowledge of the Public Works Administration's program and organization, Colonel Hackett has a wide experience in business and construction. He has a very good record in the building construction field and as an Army Officer during the World War as well as being a nationally recognized architect-engineer.

Col. H. B. HACKETT, Assistant Public Works Administrator, who will address the Society on Absorption of Steel, Sept. 26

N. J. CLARKE, Vice-President, Republic Steel Corporation, who will preside as chairman of the meeting.

M. S. CURTIS, Sales Promotion Manager, Youngstown Sheet & Tube Co., who will act as vice-chairman.



Aproduct of the Berger Mfg. Co., the above steel house structure is expected to consume a large amount of steel.

Sewage system being installed in St. Paul, Minnesota, financed by P. W. A. funds.

Another P. W. A. project — Lock and Dam construction on the upper Mississippi River.

Upper and lower views illustrate Triborough Bridge connecting Manhattan, Bronx and Queens Boroughs. This P. W. A. project involves $44,200,000.00

AN ERA OF INDUSTRIAL RESEARCH
—A CHALLENGE TO THE SOCIETY

By HARRY E. SHELDON, President
Allegheny Steel Company

Although the iron and steel industry has emerged from the depression years with a record of outstanding service to the consuming industries, it cannot rest on that achievement. It is faced with the challenge of a new era which industry is now entering, an era of stimulated research and accelerated development to produce an unprecedented efficiency of service. Upon our ability to meet this challenge rests the continued progress of the industry and the position of steel as the fundamental material of civilization.

This challenge is already manifested in greater demands on us which arise from new developments in the field of design and new efforts to effect economies which will widen the markets for steel products by reducing their cost to the consumer. The steel industry is continually breaking new ground in production methods and entering new fields of scientific research to meet these demands and has distinguished itself by its ability to comply with them.

This, however, is not enough to maintain the supremacy of steel and the progress of the industry. It is we who must lead the way, offering new materials, new methods, new processes and new efficiencies, rather than wait for the scientists and manufacturers to develop products and processes for which we shall be called upon to furnish the materials needed to make them practicable.

Our reward for making these advances will be a broadening of our ultimate markets far beyond their present scope, a diversification of demand which more than ever will stabilize our industry, an overwhelming supremacy for our products, and those tangible returns which are the legitimate reward of achievement.

In this new era which we are now entering, Science will be the guiding light of our industry. The work of the engineer, the chemist, the metallurgist and the physicist will assume a new significance and a greater power. These scientists will be drawn into closer and more significant relations with the producing organizations, as well as with their immediate customers and the eventual consumers of our products. A mutuality of interest will weld the engineer, the metallurgist, the production executive and the distributing executive into an organization of "steel men" whose united efforts will carry this industry to new heights.

It is the prospect of the industry's future which lends a significance to the annual convention of the Association of Iron and Steel Electrical Engineers, a significance which is bound to increase. Their importance to the various steel companies and to the industry as a whole may be expected to increase correspondingly and it may be anticipated that each succeeding meeting will be productive of greater benefits to the participants through the dissemination of knowledge and the exchange of ideas.

HARRY E. SHELDON
President, Allegheny Steel Company

FUTURE OF STEEL INDUSTRY

By J. FRANK BEAMAN
Business and Financial Editor
THE PITTSBURGH PRESS

▲ THE STEEL INDUSTRY which goes around, asking itself with concern, "What are we going to do with this tremendous capacity we are building up" seems to have momentarily forgotten that the only thing constant is change.

The steel makers seem to have forgotten that the industry once had a capacity of only a few hundred tons a year. And since, a thousand new uses for steel have been developed in and out of the industry.

They seem to have forgotten that in the few years that have elapsed, the inventor, the scientist and the engineer have put steel into buildings so that we have great skyscrapers today. They have put steel into the railroad sleeping car and coach, which brought safety to transportation. They have put steel into submarines, so that man can travel under the water. They have put steel into the airplanes so that flying is practical. They have put steel into houses so that they are more comfortable and serviceable. They have put steel into the utensils of home and factory so that work is more efficient.

They have put steel into things that were not even imagined when the industry was born.

They have, day after day, and year after year, changed life to the pattern of their mills.

So, unless we are ready to concede that we have reached the capacity for imagination, invention and engineering, we have not reached the capacity to consume the steel that pours in increasing streams from the new, modern mills. And for the answer to the question of how the so-called excess capacity of the industry will be absorbed, look into the minds of men.

Look to the pioneer, with his restless urge for new frontiers.

He is planning new conquests in China. He visions ribbons of modern roads into the Gobi desert, for the tourist out from Shanghai, and in exchange he will take oil concessions. He is planning to level the jungles of South America, that peaceful farmers may prosper where the Bororos hunt their food today, for that he will get mineral rights.

The horizon of these pioneer spirits is limitless but along it move the trucks, the dredges, steam shovels, oil derricks, concrete mixers, and hoists that march from the steel plants of Pittsburgh and Gary.

In the mind of the inventor you will find the challenge answered by a new house of steel, so practical that every man with a job can afford one and so meritorious that every housewife will want one. It may be a house that will change in model every year, like the auto, that there will be perpetual additions to be made and new fabricating necessary to change its features. The inventor is planning new machinery that will change the tempo of the ancient pottery art, putting it on a streamlined basis, where it has been a hand trade since Omar's day. So he plans for aerial trams, uses of radio that will decentralize newspaper printing, farms that will be modern as television.

The average man has his dreams too. He wants all of the new fangled electrical devices that make house work easier. He would like to have a new auto. He likes the modern metal furniture. Built in steel units appeal to his appreciation of progress. He would like to have something done about the mode of transportation to the office. Or if he lives on a farm he wants those new electrical devices and ding-bats his city cousin enjoys. He would like to have a new tractor, new milking machinery, a modern sewage system, and better distribution of his products and an improved method of fire, police and other protection.

In the mind of the business man is the hope that he can put in the new machinery his plant has needed for the five years of depression. He has definite expansion plans in mind and there is a new industry he could branch out into as a means of increasing profits and sustaining his labor.

And it is along these lines that the statistician's mind works. He has figured out the billions of dollars of new equipment that simply must be purchased. He has figured out that running at capacity it would take American industry five years to fulfill this latent need.

He has figured out that this demand alone should carry the nation up above the 1929 mark of activity. Or look into the mind of the economist and you will see a vision of a tremendous shift of industry, greater than the migration out of the land of the Pharaohs, but under the law of nature.

Decentralization of the great auto industry will come, they say, putting new plants in new places, just as boots and shoes have marched out of Boston. Cities will shift their population and their industrial life and new metropoli will arise in the barren wastes. These things they see as they study the charts and statistics and trends of what has been insidiously taking place.

Also these economists see what is plainly in the minds of the politicians. It isn't the expected return to a 1926 average level. Nor is 1929 the goal. The sights are set beyond both of these marks, on a new day when industry will speed at a new tempo. These things can be read in the new banking bill, the agencies adjusting the credit burden, the TVA and the Rural Electrification and similar programs.

They are substantiated too by the trend in economics. There are the charts which show the lower we drop in a depression the higher we bounce in a recovery. There are the graphs which show that after every depression in history this nation has risen to a new peak that is higher than the other one forming the valley just passed.

Then there are the new industries, the new electrical developments, the new mode in transportation that bespeak the fact that even a return to 1929 activity means more than that peak of capacity for the steel industry. Already there are new demands on the mills and men.

The new capacity that has been added since 1929, in mills from Birmingham to Detroit and from Sparrows Point to Granite City isn't a challenge.

This is but the steel men's answer to a changing world.

OPEN HEARTH CONTROL

By MARTIN J. CONWAY
Fuel Engineer
LUKENS STEEL COMPANY

▲ PROBABLY the least stationary of steel plant practices is that of the open hearth, and the common steels of today were the special steels of a few years ago. This metallurgical progress is due to the pioneer work and research of those plants who have been sufficiently farsighted to set the pace, and the industry as a whole has benefited by the generous dissemination of this information by the professional groups serving the industry in which the A. I. & S. E. E. has played no small part.

In the modern steel plant, if it is to operate to the best advantage, it is essential that the most suitable material must be supplied for use in each department. Thus, coke which will give the best results in the blast furnace, suitable coal for the producers, or the right kind of liquid fuel, suitable pig iron and selected scrap for the open hearth, ingots of correct size and nearest possible weight to meet the particular requirements of the mill at the moment should be supplied.

While the technical man on the one hand must recognize that the most expensive raw material is not necessarily the best for his purpose, the purchasing department on the other hand must realize that the lowest priced raw material is not necessarily the cheapest.

The greatest problem the open hearth has is control. Control of the raw material, especially scrap, iron, refractories, fuel, furnace lines and design; and last but not least personnel technique.

A review of current technical literature shows that all of these control problems are receiving concentrated attention, and workable solutions found that have benefited the operation, but there still remains scrap, furnace design, and the human element. Where interplant scrap is available in large amounts, reasonable facilities for segregation will assist open hearth control; where a large percentage of the scrap is of foreign origin, the problem is an entirely different one, and in

MARTIN J. CONWAY

the absence of concerted penalties sufficient to correct the errors the best purchasing procedure from reliable sources of supply must prevail.

Furnace design control with its consequent effect on fuel consumption, production and quality, probably accounts for the greatest single item in cost above net metal in open hearth operation.

This item includes selection of refractories, design of furnace lines, insulation, fuel and damper controls, burners, water cooled equipment, in fact, everything integrally connected with the furnace as an operating unit.

Selected refractories, both in size and quality are necessary for best practice, checker design is receiving attention, together with the use of a denser, more uniform grained checker brick, insulation is becoming more the rule than the exception, as is combustion and draft control in various forms of application.

Furnace lines are now up for consideration, new designs are in the making and conventional designs due for improvement, with a definite trend toward tighter furnaces and "steam line" operation.

The loss of furnace lines during its campaign robs the furnace operator of his control of the furnace and he must, therefore, be satisfied with the best results he can obtain from the design he has for use at the moment, until the economic balance has been upset and the furnace is shut down for repair.

Furnace design which can be held within narrow limits during its campaign is now within reach and we can expect changes in this direction shortly.

The human element will always be present in open hearth operations, and perpetual training is necessary not only to maintain present standards, but to prepare for future improvements.

Conditions are constantly changing; the modern steel plant is not now a plant engaged in one operation, but a combination of operations, and the key to success is an organization which will ensure the closest co-operation between the heads of departments. These men must not regard their departments as separate units, but as integral parts of the whole, and each superintendent must realize that the one thing essential is to subordinate his particular department to the interests of the plant as a whole, the object being, by the most effective team work to produce the maximum amount of finished tonnage of the highest quality at the minimum cost. A real *Esprit de corps* among the departmental heads does not end there, but rapidly permeates the whole operating organization and influences every man in the plant.

To face the competition of the future, the industry will need men of the greatest ability that can be obtained; on the technical side, highly trained men whose practice is based upon experience controlled by sound theoretical knowledge, and on the commercial side, highly trained men with a wide knowledge of fundamental business principles.

In the past our great industry has been built up by the courage, enterprise, and ability of the ironmasters and the technical men associated with them. Although manufacturing conditions have and are changing, one thing remains the same—the success of the industry still depends, and will always depend, upon the men who control it.

Operating Officials Attending Convention

C. C. WALES, Chief Engineer
Otis Steel Company
Cleveland, Ohio

J. A. VOSS, Mgr. Ind. Relations
Republic Steel Corp.
Youngstown, Ohio

S. GRAND-GIRARD, E. & M. Supt.
Sharon Steel Hoop Co.
Sharon, Pennsylvania

THE WEIRTON STEEL COMPANY

ITS HISTORY AND DEVELOPMENT

By C. H. HUNT, Assistant to President
Weirton Steel Company
WEIRTON, WEST VIRGINIA

J. C. WILLIAMS, President
Weirton Steel Company

At the invitation of J. C. Williams, President of the Weirton Steel Company, members and guests of the Association will inspect the Weirton Plant on the second day of the convention, September 25.

C. H. HUNT, Assistant to President
Weirton Steel Company

▲ THE PLANTS of the Weirton Steel Company, located at Weirton, West Virginia, are a unit of the National Steel Corporation, and in themselves represent the development of an important independent steel company, having its beginning in July 1905 in the starting of a six-mill tin plate plant at Clarksburg, West Virginia, then known as the Phillips Sheet and Tin Plate Company, by expanding through its own earnings to one of the largest tin plate manufacturing operations and broadening its operations by the addition of other lines of finished products and by complete facilities for the production of semi-finished steel required for these finishing operations from iron ore and other raw materials until it now controls all of these requirements from iron ore, coal and other materials to the final finished product.

Four years after the beginning at Clarksburg, the Company purchased a site on the West Virginia side of the Ohio River, four miles above Steubenville, Ohio, which is now the thriving steel plant town of Weirton, West Virginia, and started the erection of a ten (10) mill tin plate plant which commenced operations in February 1910, and in the latter part of 1910, increased the plant by the addition of ten (10) mills and later increased this to a 26 mill plant by the construction in 1915 of six (6) additional mills. In January 1912, the Company purchased the Pope Tin Plate Plant at Steubenville, Ohio, consisting of 12 mills so that with the addition of six more mills to the Clarksburg Plant the Company became the largest independent tin plate manufacturer in the country, operating 50 tin mills and 100 tin stacks.

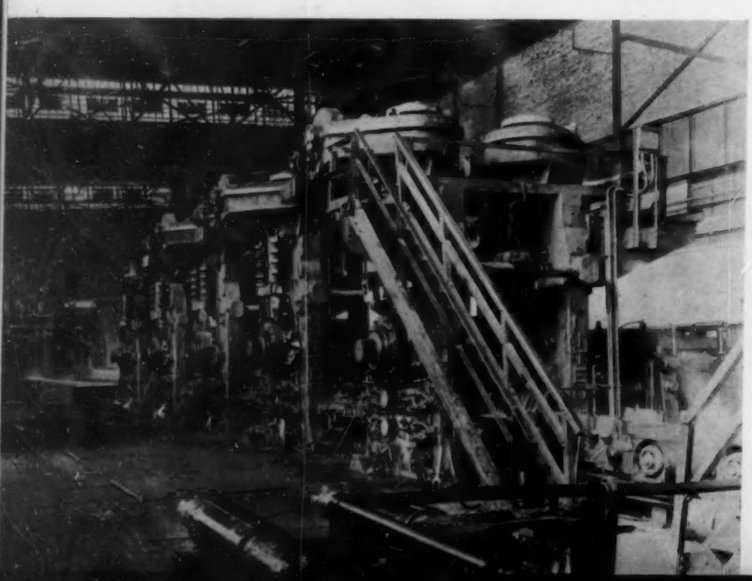
At this point, the Company branched out into other lines of the steel industry by the purchase of a cold rolling strip steel mill which had been started in Weirton in 1913, then known as the Weirton Steel Company, consisting of 18 cold rolling mills, and in order to provide hot rolled bands for these operations, shortly after

Plan View of Weirton Steel Company

commenced the construction of a 16″ hot band mill with two continuous heating furnaces, later increased to three, 20″ roughing and 16″ finishing mills; also, a 10″ hot band mill with one heating furnace, later increased to two; six (6) stands of 14″ continuous roughing and 10″ finishing mills, which were placed in operation in December 1916 and May 1918, respectively. The cold rolling department was also increased in the latter part of 1917 by the addition of 22 cold mills, making a total of 40 cold rolling mills, finishing flat rolled steel in all forms from 16″ in width down, slabs and billets being purchased for these operations.

At this time plans had been developed for the eventual construction of blast furnaces, open hearth plant, blooming, bar and billet mills to furnish steel for these operations, and early in 1918, due to the shortage of pig iron in the country required in the manufacture of war materials, the Company decided to construct as the first unit of this plant, a 600 ton blast furnace, which was blown in July 21, 1919 to supply pig iron to the market during this period and eventually to furnish hot metal when the steel plant was built. Coincident with the building of the blast furnace, the first units of the projected boiler plant and power plant were installed and were laid out so as to provide for the easy extension required for later plant developments.

5 Stand—4 High, Finishing Train of 54″ Hot Strip Mill.



The Company had acquired interests in iron ore mines in the Lake Superior region and had purchased the mines and property of the Redstone Coal and Coke Company in the Connellsville region, providing a sufficient supply of iron ore and beehive coke for the blast furnace operation.

In June 1919, ground was broken for the first unit of the steel plant, consisting of seven (7) 150 ton open hearth furnaces, 40″ blooming mill, 21″ continuous roughing mill and 18″ bar and billet mill. This plant commenced operation in November 1920.

The plant had been laid out in the beginning for construction of a coke plant on a site adjacent to the tin mill on the bank of the Ohio River with arrangements for receiving coal by river and unloading it from barges and delivering it to the coke plant, and, in 1923, the first battery of 37 By-Product coke ovens went into operation, this being the first installation of Becker type ovens to be built, and included by-product and benzol plants for the recovery of tar, ammonium sulphate and benzol products. At this time, the first units of the river harbor were constructed, providing a dredged harbor with concrete dock walls, a river hoist operating a four ton bucket for unloading coal with a belt conveyor system to deliver coal from the river to the coke plant or to storage.

During the year 1926, No. 2 blast furnace, with a capacity of 800 tons, was put into operation and also an additional battery of 49 Becker type ovens at the coke plant with increases in the by-product and benzol departments, and three more open hearth furnaces of 250 ton capacity each were added at the steel plant.

A further diversification of product had been obtained during 1923 and 1924 with the building of a sheet mill plant consisting of nine mills with annealing, pickling and galvanizing equipment for the production of black and galvanized sheets, terne coated sheets, etc.

About this period, the demand for strip steel in wider ranges was increasing and it was decided to build a 48″ hot strip mill, the first of its kind to be built, and, in conjunction with this wide strip mill, a finishing department was built, consisting of ten (10) four-high cold mill stands, together with pickling, an-

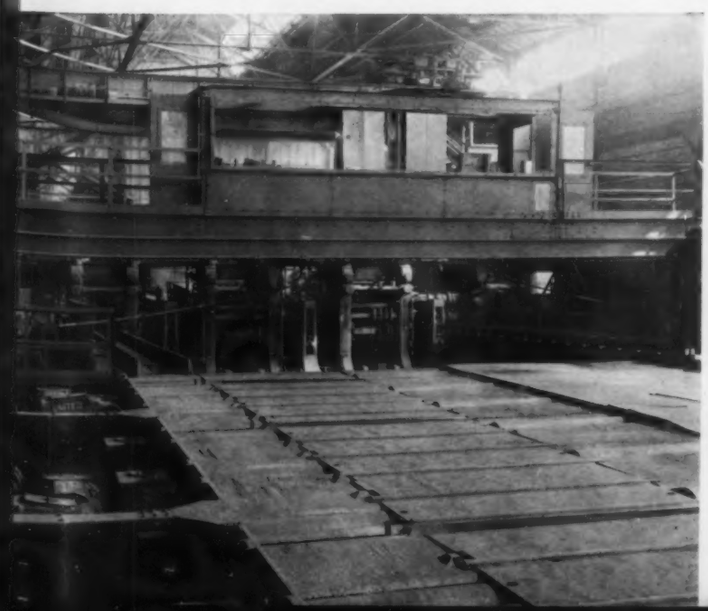
nealing and finishing departments, and later on during 1929, the finishing departments of this mill were increased 100%. To supply steel for these operations, No. 7 open hearth furnace was rebuilt for a capacity of 250 ton heats and No. 11 was added with a capacity of 275 tons and No. 12, with a capacity of 350 tons, being the largest stationary open hearth furnace ever built. The completion of the 48″ Mill enabled the Company to produce hot rolled strip from 19″ to 48″ in width and cold rolled strip from 19″ to 45″ in width, adding to the production of the company's plants, hot and cold rolled sheets, blue annealed, all pickled grades, automobile sheets, furniture sheets, etc.

During the year of 1930, the Company made some important changes to its Weirton and Clarksburg Plants. The original No. 1 blast furnace of 600 ton capacity was dismantled and a new 1100 ton furnace erected in its place. The rebuilding of this furnace required the installation of a larger skip hoist engine, rebuilding of skip hoist house, changes to hot blast and gas mains and relining of stoves, this being accomplished in the record time of 91½ days. In order to supply coke for the additional pig iron production, a third battery of 35 ovens of Becker type was added at the coke plant, making a total of 111 ovens, with the necessary additions to the by-product and benzol plants. At this time, Nos. 8 and 9 open hearth furnaces were rebuilt, increasing their capacity to 285 ton heats. No. 10 furnace was rebuilt to increase its capacity to 290 ton heats.

During this year, it was decided, in order to secure a wider diversification of products, and to utilize a surplus of steel production, to build a 28″ rail and structural mill. This mill is located parallel with the present blooming, bar and billet mills and was laid out to receive hot steel from the blooming mill, reheating it to rolling temperatures in a continuous furnace. The mill comprises a 28″ single stand three-high roughing mill with tilting tables and a train of three-high finishing stands, provided with traveling tilting tables with the other auxilliaries, such as hot saw, hot bed, shear transfer, shears, straightening and cold shearing equipment, as well as warehouse facilities for storing and shipping material for immediate deliveries.

This mill produces I-beams and channels up to 15″, angles up to 8″ x 8″ and other usual structural or merchant sections. This mill also produces tie plate and other railroad sections and contains a department for the shearing and punching, inspection and shipment of these products.

28″ 3-High, 3 Stand Finishing Rail and Structural Mill.



T. E. MILLSOP
Vice-President
Weirton Steel Co.

This gradual but steady and constant development in growth of plants and facilities up to this period formed the basis of the plant as it is at present, consisting essentially of eight units under separate operating managements.

The ore properties in Minnesota, Wisconsin and Michigan are under the management of the Hanna Iron Ore Company of Cleveland, Ohio, a unit of the National Steel Corporation. The ore is transported to the lower lake ports for trans-shipment to Weirton by the Producers Steamship Company, owning and operating seven (7) 10,000 ton ore vessels.

Coal is supplied by the Weirton Coal Company, owning 7,000 acres of coal lands in the Connellsville region and is transported from the mines to the Company's docks at Weirton in company-owned river barges.

The units under the direct management of the Weirton Steel Company comprise:

Steel Works, including docks, coke ovens, blast furnaces, open hearth department, blooming, intermediate and bar mills and the structural mill department.

Strip Steel Mills, including 10″ and 16″ hot mills, cold mills and finishing department, 48″ hot mill, cold mills and finishing department.

Sheet Mills, including annealing, pickling and galvanizing departments.

Twenty-six (26) Tin Mills, located at Weirton.

Twelve (12) mill tin plate plant at Steubenville, Ohio.

Twelve (12) mill tin plate plant at Clarksburg, West Virginia.

The Hanna Furnace Corporation at Buffalo comprising four merchant blast furnaces.

The Midwest Steel Corporation, comprising 1,000 acres of holdings on Lake Michigan in the Chicago district for future development.

Due to the increasing and changing demands of the consumer of these products for higher finishes, better quality and more exacting specifications to meet their

requirements and due to the necessity for greater production and economies in production to keep abreast of the present day requirements and usage of steel products, many improvements have been made in processing and equipment, tending toward increased production, greater economies in manufacture and higher quality of product.

For the trans-shipment of products by river to southwestern and southern points of consumption, a loading dock was constructed at the river harbor for the loading of steel products into river barges, and the coal handling and harbor facilities were increased to accommodate the additional tonnage to be handled.

Nos. 2 and 3 batteries of coke ovens were originally built so that they could be underfired with blast furnace gas in order to utilize the maximum amount of coke oven gas in the finishing departments of the plants for annealing and other metallurgical purposes. Two 30,000 cu. ft. disintegrater gas washers were installed at the blast furnace department for cleaning blast furnace gas and a main constructed from the blast furnaces to the coke ovens to deliver blast furnace gas to the coke ovens, thereby releasing the entire surplus of coke oven gas from these batteries for use in the finishing departments of the plants. This also involved the construction of a 1,000,000 cu. ft. blast furnace gas holder at the coke plant.

At the open hearth department an extension was made to the stock-house with provisions so that trains of charging cars, loaded with scrap for the furnaces, could be delivered onto the charging floor from both ends of the plant, greatly facilitating the delivery of scrap to the furnaces.

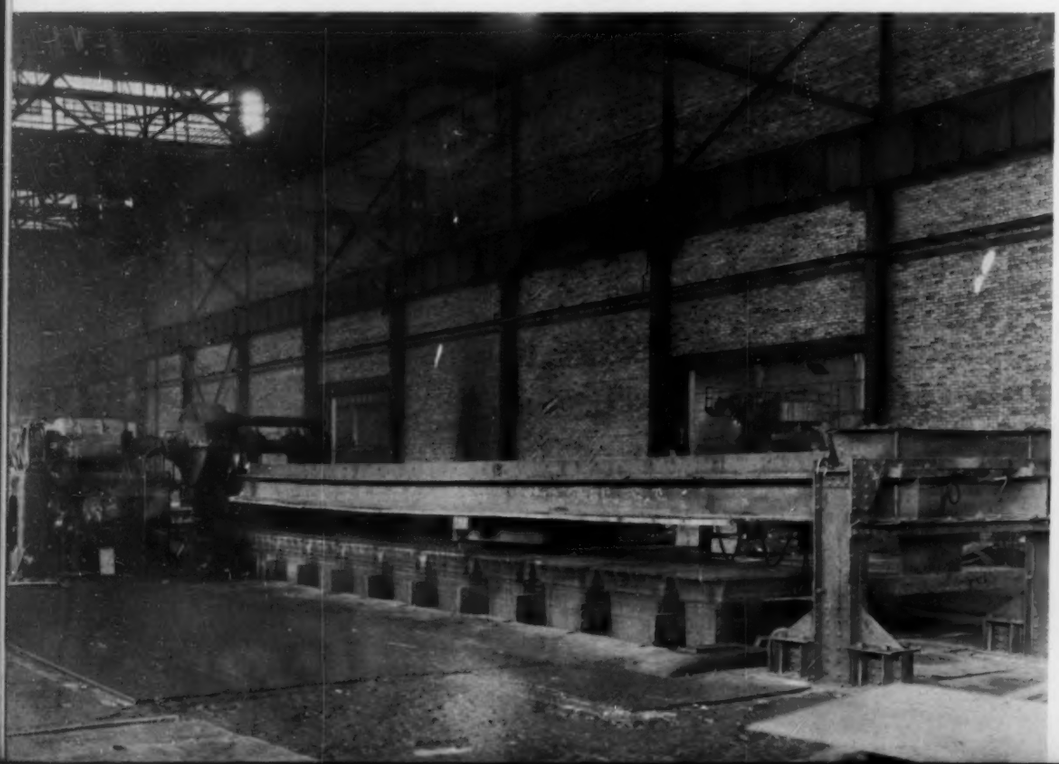
At the blooming mill, two additional rows of soaking pits were added, making a total of eight furnaces of four pits each and two of these furnaces have lately been changed by the removal of the center wall between two pits, converting them into furnaces with two large pits with additional capacity.

At the Sheet Mill, one continuous pair furnace and three continuous pack furnaces with automatic tilting

A. W. DUNCAN, Electrical Superintendent
Weirton Steel Company

tables have been installed replacing the old style of hand rolling, with additions to the pickling and galvanizing departments, providing a total of seven galvanizing and terne units, and to increase the annealing capacity, three radiant tube annealing covers have been installed.

In order to complete the range of structural shapes which were too small to be made on the 28″ structural mill, changes were made in the 10″ hot strip mill to produce small angles, squares and rounds on this mill, which is now equipped to produce angles, from 1″ x 1″ to 2½″ x 2½″, also squares and rounds from ⅜″ to 1⅜″ and for the rolling of deformed concrete bars with the necessary shearing and straightening equipment



HOT STRIP SHEAR AND PILER

E. J. ANGLIN, General Superintendent
Weirton Steel Company

and additional warehouse space to accommodate the storage and shipment of these products. This mill is therefore capable of being set up as desired to produce its usual ranges of strip steel or merchant sections within the foregoing range.

In the finishing departments of the 48″ Mill, additional productive capacity has been added so that the equipment includes three continuous strip pickling units, two roller bottom normalizing furnaces, tandem cold sheet rolling mills, tempering mills for rolling coils, pickling, additional annealing, shearing and levelling equipment, etc. The original arrangement of cold mills consisted of two trains of four-high four-stand tandem mills and two single mills, and these have been rearranged to form two trains of three-stand tandem mills for heavy gauges and one four-stand tandem mill for rolling lighter gauges and strip for tin plate. Previous to the rearrangement of these mills, three Steckel mills had been installed for rolling strip for tin plate.

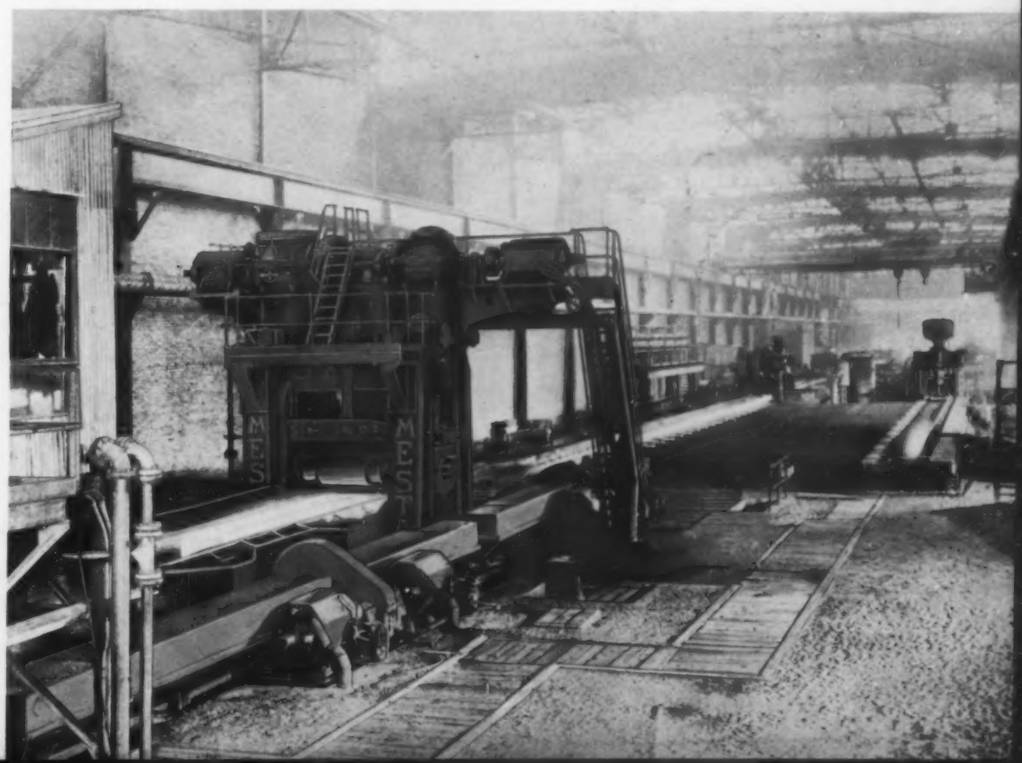
To further increase the production of tin plate strip, a four-stand four-high tandem cold mill was installed in 1934. This mill was originally designed to operate at a speed of 600-FPM and is now being changed to operate at a speed of from 800 to 1000-FPM. In conjunction with this mill, there was also installed an electric cleaning unit continuous with a flying shear and piler for cutting the strip into tin plate sizes and piling it ready for annealing, and to augment the annealing facilities, gas fired radiant tube annealing covers have been installed.

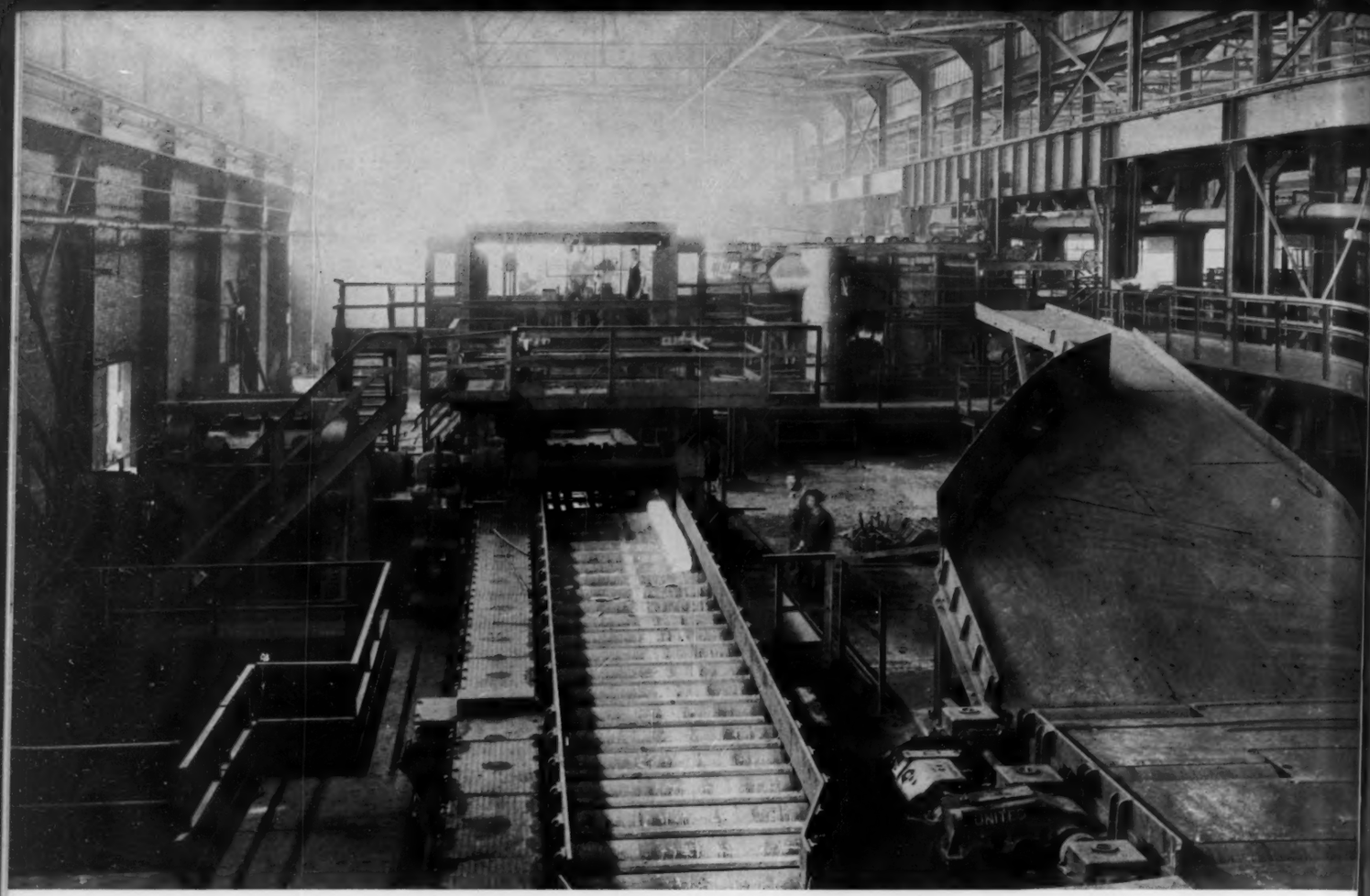
At the Clarksburg plant, the steam engine drives on the hot and cold mills have been replaced with synchronous motor drives, the first time the application of synchronous motors has been applied to driving sheet or tin plate mills.

Power for the operation of these plants in Weirton is generated from two stations. The original station adjacent to the Weirton Tin Mill consists of the boiler plant containing ten (10) 500-HP boilers and two (2) 1,000-HP boilers, generating 150 lbs. pressure saturated steam. The power house consists of two 3,000-KW 6600-volt condensing turbo generators operating at 150 lbs. pressure and two 1,000-KW condensing turbo generators using exhaust steam from the tin mill engines at 2 lbs. pressure, also one 750-KW condensing turbo generator for standby service.

The main power station located at the steel plant derives its steam from a boiler plant adjacent to the blast furnaces, consisting of four 600-HP rated capacity stoker fired boilers, burning coal, four 600-HP chain grate stoker fired boilers, burning coke braize, three 600-HP boilers fired with powdered coal, four 600-HP blast furnace gas fired boilers, two 900-HP blast furnace gas fired boilers and six 900-HP boilers, arranged

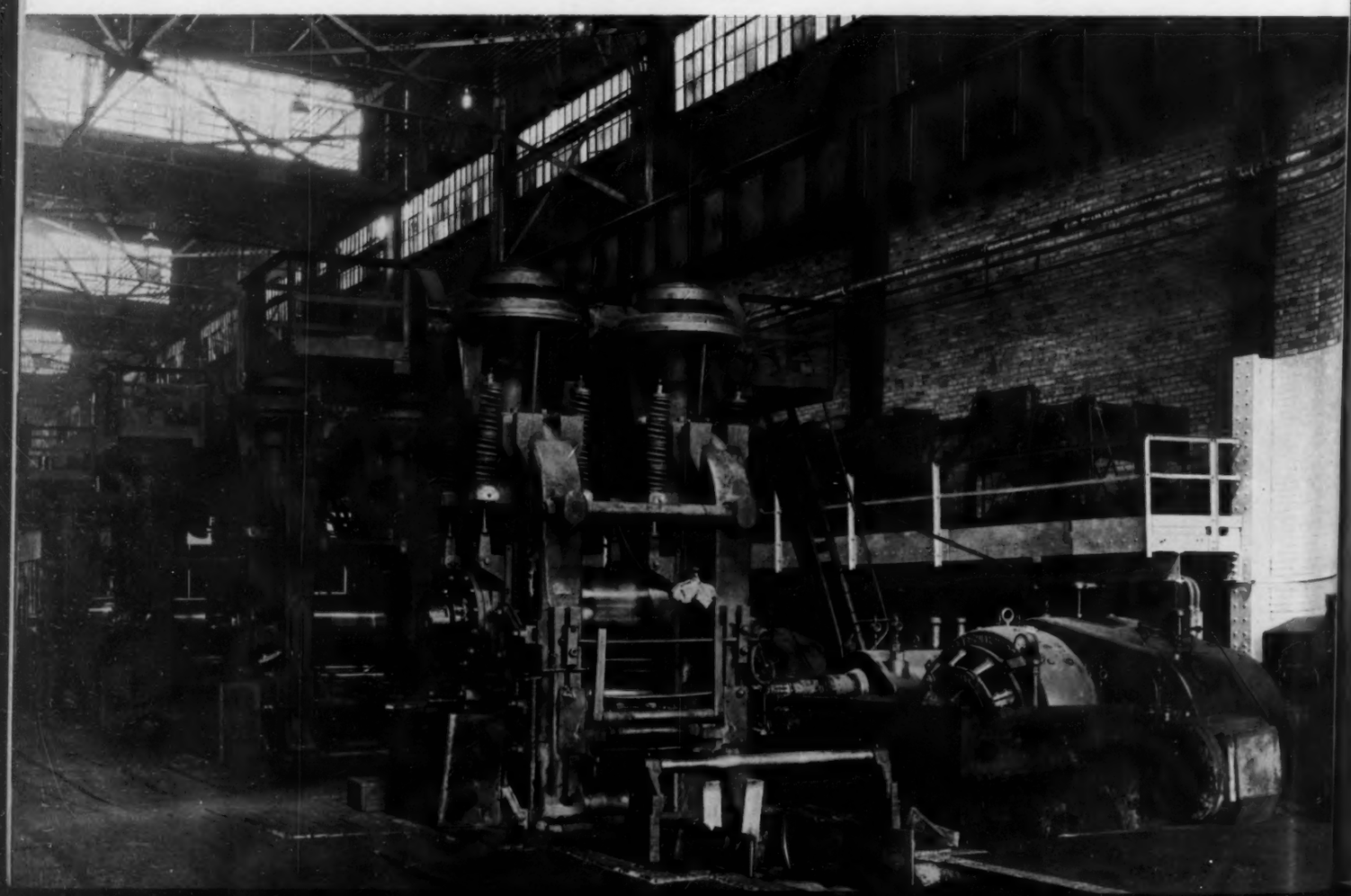
40″-2 HIGH REVERSING BLOOMING MILL





28″-3 High-Single Stand Roughing Rail and Structural Mill.

Tandem Cold Strip Mill.



to be fired by powdered coal or blast furnace gas. In addition, steam is supplied by twelve (12) waste heat boilers, one on each furnace at the open hearth plant, this arrangement utilizing the maximum of waste heat facilities in the form of surplus blast furnace gas, coke braize, screenings from the blast furnace and waste heat from the open hearth department.

The main power station located adjacent to the boiler house contains one 80,000 cu. ft. turbo blower for No. 1 blast furnace, one 70,000 cu. ft. turbo blower for No. 2 blast furnace with the original two blowing engines reserved for a standby and also contains the plant water circulating pumping station and five 7500-KW turbo generators, operating at 225 lbs. steam pressure 125° superheat, equipped with barometric condensers.

The water for condensing is delivered to this station from the main pumping station located at the river through two 30″ water mains. The water after passing through the condensers for both the turbo blowers and the turbo generators is discharged into a pump well underneath the power house pumping station and is repumped to the various plants for service water.

This power station is tied in electrically with the power station at the tin mill and they have a combined capacity for generating 45,000-KW, supplying all of the power required for the electric drives throughout the plants.

As a result of a short circuit study of the plant distributing system, a grounded neutral system was installed to protect the main electrical units from short circuit surges and lightning discharges, being the first installation of its kind to be made in a steel plant, and, since its installation in 1930, no interruptions to service of any consequence have occurred.

At the present time the productive capacity for these various plants is as follows:

Pig Iron	630,000	GT
Steel Ingots	1,312,000	"
Structural Shapes	100,000	"
Splice Bars and Tie Plates	87,000	"
Spikes	6,200	"
Plates	100,000	"
Black Sheets, Hot Rolled	69,000	"
Black Sheets, Hot Rolled & Ann.	30,000	"
Hot Rolled Strip	203,000	"
Black Plate	335,000	"
Bars	30,000	"
Cold Rolled Sheets	120,000	"
Galvanized Sheets	72,000	"
Long Terne Sheets	5,000	"
Tin and Long Terne	297,000	"
Merch. Iron (Hanna Fce. Corp.)	675,000	"

The valley in which the plants at Weirton are now located was farm land with four farm houses as the only dwellings at the time the first tin mill was laid out, while surrounding the plants at present, the communities of Weirton and Hollidays Cove have a population of about 25,000 people, almost wholly directly and indirectly dependent upon the operations of the Weirton Steel Company.

F. A. HANLIN, Vice-President
Weirton Steel Company

The town of Weirton is unincorporated and the steel company, through its subsidiary, the Weirton Improvement Company, supplies the town with water, maintains the streets and sewerage system, furnished and maintains a modern fire department equipped with the very latest fire fighting apparatus. The Company has also provided numerous well equipped playgrounds, baseball diamonds and has dedicated a wooded tract of land on the hilltop on Marland Heights, overlooking the valley and river, as a park and picnic grounds for the benefit of the people and also constructed in this park a beautifully designed brick and concrete swimming pool which accommodates 600 bathers. Adjoining the park is a beautiful 18-hole golf course, sponsored by the Company and the people of Weirton and Hollidays Cove.

The Company recently dedicated a tract of ground adjacent to the Weirton High School to the School Board and is now constructing an athletic field with football field, baseball diamond, running track for athletic events and on September 1st completed a concrete stadium on one side of the field which has a seating capacity for 3200 people, all of these facilities being for the benefit and use of the people engaged in the industries of the valley.

Inspection Trip Instructions

▲

Time—September 25, 1935—1:15 P. M. (DST)

Transportation—Special train which must be used will leave the Fourth Avenue, Try Street Yards of the Pennsylvania Railroad.

Price—$2.50 per person. Tickets must be purchased in advance at the Registration Desk in the Lobby of the William Penn Hotel.

Approximately two and a half hours will be consumed in inspecting the plant. The members and guests will have the choice of either inspecting the strip mills or the steel works.

The special train should be back in Pittsburgh about 6:45 P. M. (DST)

IN THIS SECTION

are presented complete papers and abstracts which will be delivered before the society at the convention

STEEL MILL DEVELOPMENTS

REPORT OF A. I. & S. E. E. COMMITTEE

By W. H. BURR
Electrical and Mechanical Supt.
LUKENS STEEL CO., COATESVILLE, PA.

Paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, September 24, 25, 26, 1935.

▲ CONSIDERABLE UNCERTAINTY has prevailed during the major portion of the past year, but during this period there has developed gradually a broader and better understanding concerning our duties and responsibilities toward others. During the period preceeding 1929 we gave little or no thought to such matters but since then we have been brought face to face with these stern realities.

Within recent weeks we have seen on every hand indication which tend to restore confidence in our government in business and in our fellowman. With the restoration of confidence nothing can prevent a return of better business conditions. And this prosperity will continue as long as we fulfill our responsibilities to our fellowmen.

As we look back over these lean years we cannot help but be impressed with the fact that industry has carried on development work as never before and as a result the public enjoys comforts, conveniences and improved processes such as it never enjoyed before and which could have been brought about in no other way.

W. H. BURR

CHARTS

From the information contained in the January 1935 issue of the "Iron & Steel Engineer" covering the main roll drive motors installed during the year 1934, the chart has been worked up showing graphically this information. After such a recession as we witnessed during 1932 and 1933, this seems like a real accomplishment, but when compared with 1929, it shows only about one-third as much activity. The horsepower installed on main roll drives has now reached a total of 2,840,000 but this record covers a period of twenty-nine years. What makes this 1934 record unusual is the fact that all but six of the fifty-three motors installed were in connection with hot or cold strip or sheet mills. Eighty-five per cent of the horsepower installed last year was used in the production of sheets or strip. This is another indication of the trend in steel production at the present time.

MAIN DRIVES

During the past year the change to the continuous method of producing flat rolled steel has continued at an accelerated rate. This activity was responsible for an unusual demand for electrical equipment for hot strip mills and cold rolling mills. Designs for hot strip mills now on order are characterized by the use of greater power and by the provision for higher delivery speeds. Until this year, no continuous hot strip mill had more than 3500 H.P. on a finishing stand. Three mills now under construction will have finishing stands driven by 4500 H.P. motors. Another mill, scheduled to go into operation this year, will have a maximum delivery speed of 2000 feet per minute, an increase of approximately 30% over previous practice.

New cold roll mills for production of sheet include 2—54″ tandem mills, 1—75″ tandem mill, 2—76″ tandem mills, and 1—84″ single stand reversing mill. The 54″, 75″ and 76″ tandem mills each will be driven by 3—1250 H.P. main motors and a 225 H.P. reel motor. The working rolls of the 84″ reversing mill will be driven by a 2000 H.P. motor and the reels by 2—800 H.P. motors. A 42″ single stand reversing mill for rolling tinplate will have a 1200 H.P. main motor and 2—300 H.P. reel motors. A number of smaller cold roll mills of various types have been under construction during the year. Two special mills in this class, designed for narrow material, are ring type reversible mills, each driven by a 125 H.P. main motor and 2—20/25 H.P. reel motors.

The Carnegie Steel Company is installing in its McDonald Mills a 42″ continuous hot strip mill. The

roughing end of this mill will consist of a scale breaker driven by a 500 H.P.-500 R.P.M.-6600 volt induction motor, and four roughing stands each driven by a 2500 H.P.-500 R.P.M.-6600 volt induction motor. The finishing drives, consist of one 500 H.P.-250/750 R.P.M. 600 volt scale breaker drive, one 3000 H.P.-200/400 R.P.M. motor, two 3500 H.P.-200/400 R.P.M. motors, one 3500 H.P.-135/270 R.P.M. motor, one 3000 H.P.-170/340 R.P.M. motor, and one 2500 H.P.-185/370 R.P.M. motor. The last three stands are direct connected,—all others being geared. Direct current power is furnished by three 4000 K.W.-600 volt D-C., 6600 volt-25 cycle A-C. motor-generator sets.

The Bethlehem Steel Company is installing at its plant at Lackawanna, New York, a 79″ continuous hot strip mill. The drives for the roughing end of this mill consists of one 1000 H.P.-375 R.P.M.-6600 volt squirrel cage motor driving the spreading stand, and three 3000 H.P.-500 R.P.M.-6600 volt wound rotor induction motors driving the remaining roughing stands. The finishing drives, consist of one 500 H.P.-150/600 R.P.M. -600 volt D.C. Scale Breaker Drive, three 3500 H.P.-175/350 R.P.M.-600 volt motors, two 4500 H.P.-125/250 R.P.M.-600 volt motors, and one 2500 H.P.-175/350 R.P.M.-600 volt motor. Power is supplied by two 6000 K.W.-600 volt D-C., 6600 volt-25 cycle A-C. motor-generators.

The ventilating and cooling system for the Lackawanna mill is somewhat of a departure from previous types, and we believe represents the most advanced system of ventilation used to date. The hot air discharged by the motors and generators will be drawn into hot air ducts in the basement, then through finned surface coolers which will extract the heat from it, and then the cool air will be delivered to the motor room. This means that the motor room will be the coolest place in the ventilating system, thus conducing to long life of the apparatus and comfort of the operators.

The American Sheet and Tin Plate Company is installing at Gary, Indiana, a continuous wide strip mill, believed to be an 84″ mill. The roughing drives on this mill consist on one 1250 H.P.-514 R.P.M.-6600 volts-60 cycle induction motor, one 3500 H.P.-360 R.P.M., and three 3500 H.P.-514 R.P.M. These are all wound rotor, 6600 volt induction motors. The finishing end will be driven by one 800 H.P.-150/450 R.P.M., three 4500 H.P.-125/250 R.P.M., two 4500 H.P.-100/220 R.P.M., and one 3000-125/300 R.P.M.-600 volt adjustable speed induction motors. D-C. power will be furnished by three 6000 K.W. motor-generators.

Great Lakes Steel Corporation propose to install a 79″ continuous hot strip mill on which the roughing drives will consist of one 1000 H.P.-514 R.P.M. 6600 volt squirrel cage induction motor, one 3000 H.P.-150 R.P.M. and three 3000 H.P.-514 R.P.M.-6600 volt wound rotor induction motors. The finishing drives will consist of one 500 H.P.-150/450 R.P.M. D-C. motor, five 4500 H.P.-125/250 R.P.M., and one 3000 H.P.-175/350 R.P.M.-600 volt D-C. motors. Power will be supplied by three 6000 K.W. M-G. sets.

A steel company in the New England States is installing a reversing type cold strip mill on which the main rolls will be driven by an 800 H.P.-500/800 R.P.M. -600 volt motor. Each reel will be driven by a 150 H.P.-300/1200 R.P.M. motor. Power will be supplied by a motor-generator set having a 750 K.W. main generator and a 60 K.W. booster generator.

For the Ford Motor Company's extensive expansion of its steel rolling facilities, there is being installed, among other apparatus, a complete drive for a 44″ reversing blooming mill. The mill is to be driven by a direct-connected motor, rated 7000 H.P. continuous, 50/120 R.P.M., with a maximum capacity of 275% of rated load. Power for the motor will be supplied by a motor-generator-set consisting of two 3000-K.W., 750-volt generators driven by a 5000 H.P., 13,200-volt,

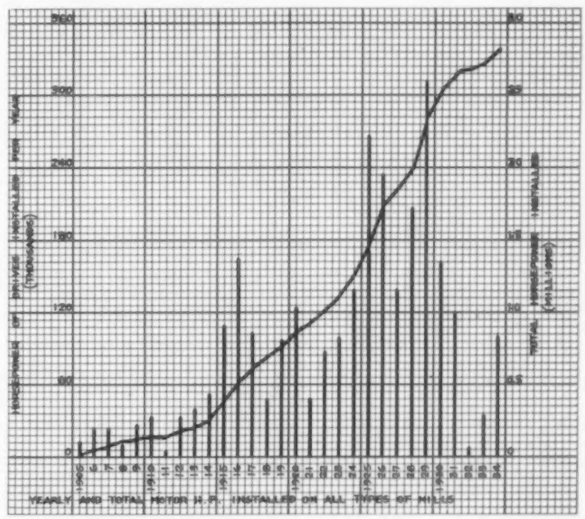


Chart showing progress of electrification in the Steel Industry.

3 phase, 60-cycle induction motor, and provided with a 50-ton flywheel having a stored energy of approximately 175,000 H.P.-sec. at synchronous speed.

With the exception of the bearing pedestals, the machines are completely fabricated from steel plates and rolled steel shapes, by arc welding. The flywheel is of steel-plate construction. The magnet frame of the 7000-H.P. motor is fabricated from four massive steel slabs each 25 ft. 10 in. long, 26 in. wide, and 11 in. thick, weighing approximately 25,000 lb. Two slabs are welded together along a circumferential seam to form each half of the frame.

At the present time, tests are being completed on an interesting and outstanding group of synchronous motors. These machines, four in number, having the following rating—two 1340 H.P., 3 phase, 60 cycle, 2 pole, 3600 R.P.M., 85% power factor, two 1750 H.P., 3 phase, 60 cycle, 2 pole, 3600 R.P.M., 85% power factor, are of interest in that the usual squirrel cage winding is entirely omitted. The tested speed torque curve gives the following values at the starting and pull-in points,—starting torque at 5000 volts equals 88%,—pull-in torque equals 175%. Reactor starting will be employed. These motors and the Elliott blowers which they drive are being installed in the Calumet Sewage Treatment Works of the Sanitary District of Chicago.

ROLLING MILLS

During the year three reversing hot-strip mills of the Steckel type have been placed in operation in this country and Canada. In these mills, the main stand of rolls is of the reversing type, either 2-high or 4-high. Above the live tables, both in front and in back of the mill, there is mounted a fuel-fired furnace in which there is a rotating strip reel. A set of pinch rolls helps to feed the strip onto and off from these reels. In operation, a heated slab is rolled back and forth through the mill, operating as a straight slabbing mill, until it is reduced to such a thickness that it can be coiled on the reels. At this stage, the end of the strip as it comes from the mill is fed into one of the furnaces and onto the reel. From this point on until the completion of the rolling, the strip passes back and forth through the mill from one reel to the other. The heated furnaces in which the reels are mounted serve to keep the thin strip hot during the entire time required for rolling, and thus permit producing a longer coil of thin strip than it would be feasible to roll on a straight reversing mill without the hot reels.

The satisfactory solution of the problem of controlling the relative speeds of the various motors taxed their ingenuity to the utmost. The speeds of the reel motors must not only increase and decrease as the speed of the main mill motor is changed, but in addition they must be adjusted automatically to compensate for the "build-up" of the coil on the winding reel, and the decrease in diameter of the coil on the unwinding reel. The control functions so that there is no appreciable tension in the strip at any time, and neither is it permitted to buckle. In addition, the reels, pinch rolls and tables have to reverse when the main motor reverses, and the speeds of the pinch rolls and tables must always be kept synchronized with that of the main motor.

There continues to be a very great deal of interest in cold-strip mills for the production of wide strip, and several have been purchased during the year. Ford Motor Company is installing a tandem cold-strip mill which is reported to be designed to operate a higher delivery speed than any existing mill rolling the same class of material. The mill is distinguished also by the fact that the main mill motors have a greater total capacity than those on any other cold strip mill so far built. There are three roll stands in tandem, each driven by a 1500-H.P., 350/700-R.P.M. motor. The tension reel will be driven by a 400-H.P., 300/1050-R.P.M., D-C. motor. This mill will be provided with a special electric equipment for automatically measuring and regulating the tension in the steel strip between the roll stands.

Schemes for rolling steel direct from molten metal have been under consideration for a number of years and installations for producing narrow brass and lead strip are in successful operation. Mills and electrical equipment are now on order for an installation of this type for producing steel and aluminum strip about 24″ wide. Mills of this type usually consist of a pouring stand, two or more hot roughing stands, trimming and cropping shear and coiler. It is proposed to produce hot rolled strip suitable for cold rolling by this method.

FURNACE EQUIPMENT

The use of controlled-atmosphere furnaces has not only become standard practice for many heating applications, but their use has been extended to new fields. New and larger types of furnaces for many of these applications have been installed.

For the Ford strip rolling mill, there is under construction a cylindrical bell-type furnace for annealing coiled steel strip which is the largest furnace of this type so far built. This furnace is designed to take coils with a maximum outside diameter of 52 in. in stacks 96 in. high, giving it a capacity of approximately 16 tons per charge. It will have an electrical rating of 240 K. W.

A steel company in the Chicago district has purchased an electric furnace equipment for heat treating alloy steel bar stock in 30 ft. lengths. The equipment includes two electric furnaces each rated 600 K.W., and a quenching equipment. The furnaces are of an elevating hood type with a car bottom. The quenching crane is automatically controlled and arranged so that the operator may select any one of several cycles at will. A single quenching crane and tank serves the two furnaces.

A steel company in the Cleveland district is installing an electric furnace for annealing steel tubes and producing either a bright or a blued finish. For the bright finish the tubes will go through the electric furnace and a continuous cooling chamber, having a controlled atmosphere throughout. For the blued finish the tubes will pass first through the electric furnace and cooler, and then into a gas heated oven in which the temperature and atmosphere will be such that the desired blue finish will be obtained. The use of gas in the bluing oven was dictated by the fact that close temperature control is not essential, and the products of combustion provide the desired atmosphere.

ARC FURNACE TRANSFORMERS

There have recently been built for the Ford Motor Company three arc furnace transformers, each a water-cooled, 3-phase unit, rated 60-cycles, 3000-kv-a., 13,200-volts primary, 239-volts secondary. Each of these units has a 12-point motor-operated 3-phase tap-changing switch which provides a total of six different secondary voltages with the primary delta connected, ranging from 239 volts to 147 volts, and a total of six with the primary Y connected, ranging from 138 volts to 85 volts. This is an unusually large number of taps to be provided in a furnace transformer. A Selsyn indicator mounted on the switchboard shows the operator at all times the position of the motor-operated tap switch. In each transformer tank is mounted a reactor connected in the primary circuit to provide suitable reactance to give stable operation of the furnace.

SHEET SORTING EQUIPMENT

A very interesting combination of electric equipment is used by one of the large steel mills to sort, according to thickness, sheets as they are cut from a coil of cold strip. The strip as it comes from the coil is fed into a flying shear which cuts it into uniform lengths. Just previous to entering the flying shear, the strip passes between the rolls of a Pratt and Whitney continuous

electric gage. As long as this gage indicates that the strip passing between its rollers is within the commercial tolerance for thickness, the cut sheets are delivered over a roller-conveyor to the "stagger piler". If any part of the coil of strip is thicker than the commercial limits, the indicating instrument connected to the electric gage closes one set of contacts which, through a Thyratron relay, energizes a solenoid which in turn throws a switch on the roll table over which the sheets are delivered, causing the "thick" sheets to be delivered to another pile. On the other hand, if the gage indicates that the sheets being delivered are too thin, a second Thyratron and solenoid combination operates to throw a second switch, delivering the "thin" sheets to a third pile. The good sheets, in traveling to the piler, pass between a light source and a phototube connected to a "lot counting" relaying equipment which in turn controls a solenoid on the stagger piler. The lot counting equipment is adjustable so that the solenoid on the piler will operate after any number of sheets, from one up to ten, and this causes every group of, say ten sheets, to be offset slightly in the pile in relation to the groups immediately beneath and above it.

This equipment greatly reduces inspection cost and facilitates handling of the stacks of sheared sheets.

TURBINES

A review of industrial practice in power plant design indicates conservatism as one of its inherent characteristics. When reliability has been proved, industry has welcomed improvements to reduce power and steam costs. The steel industry uses a large amount of moderate-pressure steam for other purposes than electric power, which condition results in a favorable opportunity to realize the energy available between high and existing-plant steam pressures by the use of non-condensing steam-turbine generators. Developments in steam plant design over the past ten years, combined with turbines suitable to the expanding energy range, have resulted in the realization of high efficiencies. Enough of these plants have been in operation for a sufficient length of time to permit an accurate estimate of their reliability. Some examples of present-day plant conditions show how the imposition of a high-pressure boiler and turbine-generator will affect the fuel and water-treating costs, or the plant electrical output. The improvements indicated lead to the conclusion that, for similar cases, the possibilities are sufficiently attractive to suggest a close investigation of the super-imposed plant. Resort may be made to the use of evaporators in order to secure the necessary purity of boiler feed water at some reduction in operating savings but, from a technical standpoint, chemical treatment with elimination of precipitated solids appears to be a feasible solution to this vital problem.

With less expensive electric power, the applications of mechanical power by steam will be less attractive, in many cases to the extent that some may show greater economy if changed to electric drive. Electric heat treating, welding, and other uses continue to add to the value of metal products and produce a higher electric consumption per unit of product, so reducing the generating reserves and tending toward the expansion of the electric power plants. The need for added, less expensive, electric power is increased by these means. The super-imposed steam-turbine-generator plan offers the possibility of an economical means to meet these demands.

As an example of one of the types of installations described above, the non-condensing, 15,000-kw. turbine-generator ordered for the Rouge plant of the Ford Motor Company in connection with their expansion

Youngstown Sheet & Tube Company's new hot strip mill which started operations in March, 1935.

program is typical. It will operate at steam conditions of 1200 lb. gauge, 900 deg. F. at the turbine throttle against a back pressure of not more than 250 lb. It is expected that the back pressure will vary, and under these conditions the load on the generator will also vary. The heat available from the exhaust of this turbine will be converted, through evaporators, to generate other steam, which in turn will be used for 250-lb. turbines or passed out of the power station to factory processes. This turbine-generator will operate in parallel with two condensing turbine-generators both using 1200-lb. steam and each capable of producing 110,000 kw.

AUXILIARY MOTORS

The year 1926 marked a major improvement in the steel industry when the production of rolled strip was increased from 24″ to 36″ in width. Since then rapid strides have resulted in producing strip in widths over twice that size and at far higher speeds. This has meant more rugged, quicker starting and stopping motors on run-out tables and coilers. The mill production depends upon the uninterrupted performance of these motors. By constantly consulting with steel-mill electrical engineers and improving designs, builders of auxiliary motors have been able to meet the more severe conditions. Thousands of these improved motors are contributing to the success of continuous strip mill operations. Today, based on this experience, auxiliary motor builders are prepared to meet the ever-increasing demands imposed on these smaller motors in the modern mill. One of the leading small motor builders now has a complete line of motors consisting of pipe ventilated gear motors for run-out tables, a flange-mounted water cooled induction motor and also a flange-mounted fully-enclosed fan-cooled induction motor, both used for coilers.

Numerous improvements and refinements in auxiliaries such as flying shears, coilers and runout tables are being incorporated in the latest hot strip mill installations. Strip mills placed in operation this year and still under construction require a total of 2500 to 3000 of these motors. While early installations of individual roll tables were designed for continuous operation at light load, individual roll drive is now used for heavy duty service requiring frequent starting and reversal. The totally enclosed fan cooled squirrel cage motor in capacities up to 15 H.P. is generally accepted for this service.

Twelve squirrel-cage induction motors of special design have been built to drive the rollers on two coilers which are used to coil the hot strip as it comes from a 60 in. continuous hot strip mill. These motors must start and stop very frequently, their speed must be adjusted to conform with the delivery speed of the mill, and they operate in a location where they are subject to heat, steam, and water spray. Each motor is rated 8/2.67-H.P., 75-degrees C. continuous, 1230/410 R.P.M., 450/150 volts, 61.5/20.5 cycles.

These motors are totally enclosed and water tight. Special composite seals, held against the shaft by springs, prevent entrance of water through the bearings. The motors are flange mounted, being bolted directly to the coiler framework.

Power for the motors on each coiler is supplied by an adjustable speed D-C./A-C. motor-generator which permits of adjusting the operating speed of the coiler rolls. Quick and positive stopping of the coiler rolls is obtained by disconnecting the motors from the A-C. supply and applying direct current to the stator windings, thus dynamically braking them to rest.

A new mill type motor has been designed, and gives promise of being a worthy successor to a line which was among the first successful mill motors introduced into the steel industry and which has, for nearly thirty years, been a leader in applications for heavy mill auxiliaries.

This early type mill motor, while retaining its fundamental features of design over this long period, was constantly improved in details recommended by steel-mill engineers. The new mill type motor retains these desirable features and adds the advantages of dimensions standardized in accordance with the recommendations of the Association of Iron and Steel Electrical Engineers.

Features of design include: frames horizontally split and equipped with removable hinges; heavily designed cartridge-type bearing housings (motors are arranged to accommodate all standard types of anti-friction bearings); interpoles designed to give exceptionally good commutation under all conditions encountered in steel mills.

Two planer-type motors recently completed are to operate a roller table carrying hot strip steel from roughing to finishing stands. For the most part, operation is in one direction but, when the rolls are being cleared of obstructions, the motors are required to "rock" the roll table (reverse the direction of motion repeatedly so that the strip will not be marked where it would rest on the rolls if standing still). Motors at full-field speed are plugged with 150 per cent current, run a few revolutions in one direction, then are plugged with 150 per cent current, and run a few revolutions in the other direction.

The motors are rated 50 horsepower continuous duty over the entire speed range of 250 to 1000 R.P.M. Temperature rating is 55°C. rise for 250 to 500 R.P.M. and 50°C. rise from 500 to 1000 R.P.M. (with solid top and gauze bottom covers in place).

BLAST FURNACE BLOWERS

The Republic Steel Corporation is installing at Buffalo what is believed to be the first motor driven blast furnace blower. This is a centrifugal compressor, driven through a step-up gear from a 6000 H.P.-750 R.P.M. motor. The output of the compressor will be controlled by the Ingersoll-Rand Company Power Wheel.

CONTROL

Complete electric control systems were developed for use with continuous pickle lines and these were installed at the American Sheet & Tin Plate Company at Gary, Indiana, and at the Ford Motor Company at Detroit, Michigan. This control system permits continuous movement of the material through the acid tanks at a predetermined rate and provides for feeding

in new coils, shearing off the front end of the new coil and the rear end of the old coil and stitching them together without stopping movement of the material through the tanks. On the delivery end provision is made for cutting out the stitch and coiling up the end and starting a new coil without stopping the material going through the tank. Control equipment is also provided for automatically maintaining the motors along the line in speed synchronism so as not to pile up loops between tandem devices.

During the year there was developed and built for the Aetna Standard Engineering Company of Youngstown, for the Inland Steel Company, and Youngstown Sheet & Tube Company automatic control equipment for uncoiling the strip and shearing it up into proper lengths. These applications look to have a great promise in today's sheet mill practice.

Several notable developments have been made in simplifying high speed, light hook lowering crane hoist controller and a number of other installations.

A special contactor has been developed for handling heavy low voltage currents such as are used for low voltage butt welding. The inductance of buses, even when interlaced as much as possible, introduces a serious problem in interrupting heavy currents at low voltage. A contactor with a continuous direct current rating of 150,000 amperes and an interrupting capacity of 200,000 amperes at 7½ volts has been constructed. The space occupied is about the same as for a conventional blooming mill screwdown panel, or a small fraction of the space required for carbon circuit breakers of the same rating.

MAGNETIC CLUTCHES

A newly designed general purpose magnetic clutch, with a number of important improvements, has recently been announced. An outstanding feature of the new clutch is the method of adjusting the friction faces to compensate for wear and to assure uniform lining engagement. The inner circumference of the field ring is threaded and the adjustment is made by rotating the field ring, in respect to the magnet field member, and consequently moving it toward the friction surface on the armature member. When the field ring has been moved forward sufficiently to compensate for the wear, it is locked firmly in position.

A floating magnet armature is used in the design of the new clutch, making it impossible to score the magnet pole faces even if proper adjustment on the lining is not maintained. This feature overcomes the disadvantage of the conventional single friction face clutches, on which grooving and scoring of the magnet poles results from improper maintenance of lining adjustment.

Other features of the new design include a magnet coil which may be readily removed and replaced as a unit, rugged bronze collector rings, a lining wear indicator, and a pilot bearing to insure concentric engagement of the two members.

CRANES

During the year 1934 forty-eight new cranes were purchased for the steel industry. Thirty-seven of these cranes were D.C. and eleven A.C., which would indicate a trend toward the more general use of A.C. motor driven cranes in the steel industry.

One improvement which has been made is a new crane bridge drive, in which the motor (plain type) is located at center of span and close to the girder. Both ends of armature are extended through couplings to either end of crane and coupled onto the gear reductions which are housed in oil-tight cases, cast or welded integral with the trucks or end carriages. Some of the advantages from this new drive include: narrow footwalk of uniform width the entire length of crane, thus allowing greater bridge travel and more floor space covered,—reduction of torsional stresses and overhanging loads at center of span, making unnecessary an outrigger girder,—smoother running, less vibration, and elimination of oil leaks,—permitting the use of low torque brakes at each end of drive.

An adapter, to be used in connection with a rope type ingot stripper, whereby big end up ingots can be extracted, thus converting machine into a combination stripper and extractor, has also been developed.

TUBES

The measurement, recording, and controlling of operating temperatures in the iron and steel industry has been greatly extended by the use of fixed focus radiation thermotubes. They are used with a thyratron tube driven recorder to measure and record temperatures in two seconds and temperature changes in approximately one second. Several installations are in operation on the finishing stands of hot strip mills, others on the roughing stands of rod mills, and others on skelp mills at the forming bell. In this way the actual temperatures of the steel are obtained during processing.

A portable thermotube unit is being used to measure the temperature of ingots in soaking pits. By the use of this unit it is possible to check the temperature of a bank of four pits in less than thirty seconds. Another application of the thermotube is to measure and control temperatures in bright annealing furnaces where the hydrogen penetrating the protection tubes on base metal thermocouples causes the couples to change calibration. Thermotubes are being used for Open Hearth roof temperature-limit control and also to measure the temperatures of checker brick in the hottest section of the checker chamber. Other applications of thermotubes in the steel industry include temperature measurements in forge furnace walls, recuperator flues, box annealing furnaces, etc., etc.

METERS

The torquemeter is a most accurate device used to measure the power of rotary machines. Unlike the prony brake, it is not subject to the difficulties of maintaining a constant load nor to the errors of the dynamometer due to windage and bearing friction. The torquemeter takes the form of a coupling for connecting the shafts of the prime mover and the driven machine. It consists of a specially made helical spring encased in a housing in which the torsion is indicated by a needle moving on a graduated scale. On changing load the torquemeter assumes a new position instantly and

without oscillation. A vibroscope is furnished for reading the deflections.

There have recently been taken some interesting graphic records made on electrical welding equipment. These graphic records were made on several types of the most modern high speed welding equipment, and it is interesting to note that almost every type of welding equipment makes a characteristic type of record. When welding is done by those methods where the current is on for two or three seconds, the graphic instrument will provide a record showing the value of the current through out each instant of the welding cycle. Variations in time as well as welding current are very easy to detect. The meter acts in many cases as a ballistic galvanometer, the variations in the height of each swing indicating variations in welding current. Any variations in welding current such as caused by scale on the material being welded or failure of the control circuit to make the proper connections, can be readily detected on these records. Such systems of keeping track of production welding are of great assistance to the operator as well for they enable him to quickly detect whenever the equipment he is using fails to function as it should.

On the new continuous strip mills now being erected, graphic instruments are being employed quite extensively. There are two general types of applications. One of these consists of the use of combination speed recorders and graphic ammeters or wattmeters on each stand. The speed recorders keep a record of roll speed, and the ammeters or wattmeters, the power input to the motor driving the rolls. Since the tension of these steel slabs when passing between these roll stands at high speed is of vital importance, the power input driving these rolls is an excellent indication of the amount of pull each motor is contributing.

Another prominent application of graphic instruments found in the new strip mills is on their convertors supplying D.C. power to the mill motors. An A.C. wattmeter is used in the input side of the convertor and a D.C. voltmeter on the output side. In a number of cases, power factor recorders are also used in conjunction with A.C. wattmeters. It is our belief that these steel mill applications represent some of the finest work being done with graphic instruments, much of which can probably be attributed to the progressive attitude on the part of the electrical engineers in charge of such equipment.

There is urgent need to integrate flow more accurately than is possible with previously available meters. Exact heat balances, accurate accounting, the economic importance of small differences in the efficiency of large units, all demand it. In one of its last reports, the N.E.L.A. Prime-movers Committee stated the case for the power field as follows: "The importance of high accuracy and dependability of metering equipment in large-scale power production can hardly be overstated". The conditions necessary to high accuracy of integration are fulfilled and are offered after exhaustive research for the correct integrating principle.

This meter utilizes a principle which permits direct integration, free of intervening instrument errors and of linkage variables—flow integration that is as direct as watthour meter integration of electrical energy. It integrates directly by making use of a basic fact, that centrifugal force exerted by a flyball system has the same relation to rate of rotation that manometer pressure has to rate of flow. A tilting manometer is used, balanced directly against centrifugal force developed by integrator rotation. Flow controls manometer pressure. This manometer pressure is balanced by centrifugal force. Centrifugal force is controlled by rotation. Rotation then measures flow.

There has recently been completed a dilatometer, an instrument which measures and records in ten-thousandths of an inch, the expansion and contraction of metals as they are heated and cooled. The device was built from specifications of the United States Bureau of Standards for use in investigations regarding metals, and is not a device that is being marketed.

The dilatometer consists of a small cylindrical furnace surrounding a quartz tube—the quartz withstanding high temperatures and having a minimum of expansion when heated. A round core of about the size of a thick pencil and made of the metal to be tested is placed within the tube, which then electrically heated up to 1800° F. On top of the specimen is placed another smaller quartz tube, sealed at both ends, to transmit the dilation of the specimen to a dial gauge. The gauge is connected by an Invar clamp to the outside quartz tube, and can be read to 0.0001 inch.

Metals do not expand in an even, gradual way as the temperature is increased, investigations have shown. Instead, they react in an irregular fashion, expanding in spurts. Often, when a certain temperature is reached, the metal under test will contract in spite of increased heat, and then once more expand at a still higher point of the heat scale.

With the dilatometer such irregularities can be determined accurately. In welding, brazing or heat treating, information on the reaction of the metals involved to heating and cooling is very valuable. If it is known in advance, a variation in the rate of expansion or contraction can be taken into account by carefully controlling the temperatures of each metal. Complications arising from irregularities shown in the way certain metals respond to heat at critical or irregular points may also be avoided through proper heat adjustment. By testing various alloys of different compositions with the dilatometer, it is possible to tell how individual elements are affected by heat variations. After this has been determined it is possible to raise, lower, or even eliminate the critical points of a steel compound, for instance, by adding certain elements. In this way, a compound can be created with nearly any characteristics of expansion and contraction that may be required.

WELDING

An interesting installation of automatic welding equipment was made at the Cartaret, New Jersey, plant of the Foster Wheeler Corporation. The automatic electrode-feeding device is designed to feed heavily coated coiled electrodes, utilizing alternating current for the arc. Current is applied to the electrode

by steel brushes passing through a small slit which is automatically cut in the covering of the electrode by a milling cutter incorporated in the welding head. In the first five months of production, operation of this plant, producing Class 1 pressure vessels, defective welds amounted to only 0.04% of the welds produced. All welds are examined by means of an X-ray equipment.

A new portable resistance-type stud welder has been developed to provide a quick sure method of attaching studs to metal surfaces. In this equipment, a specially designed transformer, providing an output of several thousand amperes at very low voltage, and a control panel, are mounted in a portable steel cabinet. Air-cooled cables connect the secondary of the transformer to the stud welding "gun" which the operator manipulates. In operation, the stud, which may be up to $\frac{5}{16}$" diameter and 2½" long, is placed in the end of the gun, the operator forces the stud and gun against the metal surface to which the stud is to be attached, and presses the trigger. The control permits the heavy current to flow through the stud to the metal surface and back through the gun to the transformer for a period of time sufficient to accomplish the weld. This equipment is finding considerable use in ship construction.

LIGHTNING MEASUREMENTS

The amount of current in a flash of lightning ranges from approximately 4,000 to 220,000 amperes and practically always come from negatively charged clouds. In many places, magnetic records of the current in flashes of lightning are being obtained, using a new surge-crest ammeter to measure and interpret the effects of the lightning on "magnetic links" mounted close to transmission towers. The information thus gained, coupled with lightning voltage measurements as obtained with the oscillograph, and with studies such as those made in the high voltage and high current laboratories, where man-made strokes of 10,000,000-volt lightning are employed, serves electrical engineers in many ways.

Small pieces of magnetic material, called magnetic links, are mounted on brackets and installed within a few inches of one or more legs of the transmission tower. Several thousand such links are in use along various transmission lines. The magnetic link is so designed that a stroke of lightning in passing through the transmission tower magnetizes the link in proportion to the highest value of current in the lightning bolt. Line patrolmen, working under the research staffs of the power companies, make regular examinations of the links and upon discovering, by means of simple instruments, that a link has been magnetized, remove it and turn it over to the engineers. The magnetized links, when placed in the magnetic measuring instrument, known as a surge-crest ammeter, cause the pointer of the ammeter to indicate on a scale a measure of the highest value of current in the lightning bolt.

It has been established that roughly seventy-five per cent of all interruptions to electric service are caused by lightning. How to get rid of these interruptions has been the great concern of electrical engineers, and field researches, together with resulting protective apparatus developments, have already brought lightning-proof transmission lines close to practical realization.

CONCLUSION

May I quote from the April issue of the "Atlantic Monthly" an article by Arthur Pond in which he sets forth better than I could ever hope to do the real value of research work.

"In this swiftly changing world, research is the price of continued existence for any large industry depending upon marketing complicated goods and services. The shock troops in the army of progress are the men of science. Politics may beat the drums, finance may move the heavy baggage trains, social workers may help the afflicted and physicians mend the wounded; but science wins the ground, and the rest of us march along in its wake to consolidate its gains."

It has been my privilege to serve this association in the capacity of Chairman of this Developments Committee for a number of years and each year I realize more fully the debt which I owe the members of this committee who make this report possible and yet the nature of the report is such that these men cannot be given the credit which they deserve for the service which they render this association.

Realizing this and not knowing a better way, may I again express to all the members of this committee whose names are given in the October issue of the "Iron and Steel Engineer" the sincere thanks of this association and to this add my own thank you for your continued support and cooperation in compiling this annual report for the years 1934-1935.

Please Note:

Tickets for Inspection Trip to Weirton Steel Company, September 25, 1:15 P. M., must be purchased in advance at Convention Registration Desk, Lobby William Penn Hotel.

The Flat Rolling of Steel

By C. L. McGRANAHAN
Supt., 76" Hot Strip Mill
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE PRODUCTION of wide strip in light gauges on a continuous mill was termed, by a prominent consulting engineer in 1927, the outstanding development of that decade. This statement is equally appropriate when applied to the present decade, as the year 1935 is no doubt witnessing the peak year for the construction of 4-high broad strip mills. One new broad strip mill and one modernized mill have already been placed in opera tion, a third mill can be started up at the owners will and work is being pushed vigorously on four additional mills, whose starting dates have been set for late this year or early in 1936. This advancement in the art of rolling has been made possible only by the close co-operation of the mill builder, the electrical machinery manufacturer, the furnace builder, the roll foundry and the mill operators.

Many problems in connection with the flat rolling of strip date from the beginning of the industry, however the production of broad strip at high rolling rates has introduced additional difficulties, aggravated some of the older ones and mitigated others. The equipment manufacturer has responded in a gratifying manner, when called in to assist the mill operator in solving the mechanical problems. In practically every case suitable equipment has been designed and constructed to lessen or completely eliminate the trouble.

The result of this cooperation has been the more or less standardization of broad strip mills and a resulting increase in competition due to improved quality of the product.

The buyers market, which has prevailed for a period of approximately six years, has been so exacting in its demands, that a hot rolled sheet has to practically approach a blued cold rolled sheet in surface and flatness before it constitutes a commercial delivery. To reduce a broad strip to gauge in a modern mill is in itself, not an extremely difficult task. To produce a strip of the proper surface requirements and of such a shape that it can be flattened without destroying this surface, is easy or difficult, depending upon the amount of thought that has been given to the selection of the slab, the rate of heating, the percentage of draft in the various mills, and the condition of the working and backing-up rolls, when the section is being rolled.

When all the new mills now under construction or proposed are completed, there will no doubt be periods of 100% operation for everyone as well as slack periods.

C. L. McGRANAHAN

The operator is then faced with the problem of producing the best possible sheet in limited quantities with a reasonable cost, upon a machine designed for mass production. With proper consideration to all the various factors entering into the rolling of flat strip steel, this is not an unsurmountable task.

Individual Drives for Runout Table and Coiler Rolls

By L. E. HILDEBRAND
and W. B. SNYDER
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE PERFORMANCE of the electrical equipment, —representing an investment of from $100,000 to $400,000,—associated with the runout tables for the modern strip mill contributes in no small measure to the satisfactory and profitable operation of the mill. The most careful study is warranted to insure that the maximum in usable performance and economy is designed into the table drive. The component parts of such a drive are induction motors, adjustable frequency sets, and magnetic control, all of which are well known. The designer's problem, therefore, becomes one of selection and coordination, in choosing the units which, in combination, produce the best results. Like the

modern automobile, the modern runout table drive must be built as a unit and not assembled.

While all runout tables are at times operated continuously at full speed, at other times they must operate on a duty cycle of frequent and rapid acceleration and deceleration. The latter type of operation is always the limiting one in the selection of the electrical equipment. Such a cycle imposes two problems on the drive: (1) to develop sufficient torque to meet the desired time of operation, and (2) to be capable of handling the energy requirements without undue heating. Horsepower rating as normally given by motor manufacturers is not a satisfactory criterion, or measure, of a motor's performance in either respect when used on a runout table duty cycle.

Three types of squirrel cage motors have been widely used as individual drives for runout table rolls. These are: (a) the normal low resistance squirrel cage induction motor; (b) a motor with a moderate high resistance squirrel cage, sometimes known as the semi-high-torque motor; and (c) the true high resistance squirrel cage motor, or the high-torque motor. The normal motor is the best of all types for continuous running, having the highest power factor and efficiency and the lowest slip, and is the poorest for starting, plugging or dynamic braking since under these conditions it develops the lowest torque and draws the highest current of any of the three types. The semi-high-torque motor has running characteristics almost as good as the normal motor, and has somewhat improved starting and stopping characteristics. The high-torque motor has the poorest running characteristics and the best starting and stopping characteristics of the three types.

W. B. SNYDER

L. E. HILDEBRAND

It is well known that the kinetic energy stored in a drive represents a fundamental unit in problems of acceleration. Each time a motor is *started* by connecting it to a constant frequency bus, or *stopped* by dynamic braking, one of these units is dissipated in heat in the rotor, and each time it is plugged to rest three units are similarily dissipated. There is also a similar but usually smaller loss in the stator windings. This is the extra loss due to acceleration and deceleration, and is in addition to the normal losses of the motor. One of the designer's chief problems is to provide means for getting this heat out of the motor, thus keeping its temperature rise at a reasonable value. It is not so widely appreciated, however, that when an induction motor is accelerated or decelerated by raising or lowering the applied frequency, the motor is really operating under running conditions, and that the only losses are the losses incident to normal full speed operation. The acceleration and deceleration losses disappear entirely. The same thing is true of the acceleration or deceleration of a direct current motor through its field controlled speed range. Thus, means are available for starting and stopping adjustable speed runout table drives, which are far more efficient than the conventional

method of starting at full voltage and frequency, and plugging or dynamic braking to rest from full speed. The table motors may be started with the adjustable frequency set running at minimum speed, and then the motors and M-G set may be accelerated together by weakening the field of the d-c motor driving the set. On deceleration, the set may first be brought down to minimum speed and frequency, pumping back most of the stored energy into the d-c supply, and then the table motors may be plugged or dynamic braked to rest. The accelerating and decelerating losses are only a fraction of those incurred by the more usual method of starting and stopping.

This method of starting and stopping, in addition to reducing the losses in the table motors, and thus increasing their life, has other benefits. It permits the use of normal squirrel cage motors on the table drives, since at low frequency these motors have excellent starting and stopping characteristics, and since the acceleration and deceleration over the frequency range becomes a running duty, for which the normal squirrel cage motor is ideally suited. The demand on the adjustable frequency set is reduced both because the acceleration and deceleration losses are lowered, and because of the better efficiency and power factor of the normal motor under running conditions. Of course, the motor driving the set has the added duty of accelerating and decelerating the set itself, but this is usually more than offset by the reduction in losses in the table motors.

There has been much discussion recently as to the relative merits of plugging and dynamic braking as the means of bringing runout table motors to rest. If the motors are to be decelerated from high speed, dynamic braking is to be highly recommended as the reduction in decelerating losses will usually produce material saving in the cost of both motors and M-G sets. However, if the drive operates over a wide speed range, and is decelerated to minimum speed by lowering the frequency and voltage, then the reduction in total losses by using dynamic braking rather than plugging is inappreciable, and the choice of the method of final stopping is determined by the operating requirements. For example, runout table drives are frequently provided with reversing features for use in emergency. In this case, plugging is recommended as the method of final stopping, since it requires no additional equipment whatever, and since the operator can determine the proper instant for disconnecting the motors. On coiler drives, however, reversing features are not necessary, and it is difficult, if not impossible, for the operator to determine when the coiler has come to rest. For these drives dynamic braking is strongly recommended.

This method of acceleration and deceleration by frequency variation is not new or untried. It has been in operation for about four years on the tables of a wide hot strip mill in the Chicago district, and for almost a year on the coiler drives of a wide hot strip mill in the Pittsburgh district. It has proved amply rapid to meet the most severe requirements of acceleration and deceleration, and is benefiting the users in decreased power bills and reduced maintenance.

Lubricants for Cold Rolling Strip Steel

By DR. R. W. MOORE, Physicist
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

DR. R. W. MOORE

▲ THE LUBRICANTS discussed in this paper are those which are used on a strip of steel passing through a finishing mill, during the final stages of processing. The term by which these lubricants are known is "Roll Oil", of which there are a number of types.

The more modern mills on which these "Roll Oils" are used might be grouped in two classes. (1) The tandem mill, which usually consists of three or more four high finishing stands, through which the strip passes in one direction in a continuous finishing process. In rolling sheets the first stand frequently rolls the strip dry, which is a surface leveling pass, and then the roll oil is applied between the first and second stands. When rolling tin plate, the roll oil is usually applied before entering the first stand. The remaining stands then take the finishing draughts with the strip coated with the roll oil. On this type of mill the rolls are driven and the strip is fed in, in a free manner to the first stand, and coiled onto a tension reel from the last stand.

E. S. REYNOLDS

The second class of mills would cover the type having a single four high stand and two tension reels, and the strip is drawn through the mill from one reel to the other, and then reversed, and so on until the desired gauge is obtained. On some of these mills the reel draws the strip through the work rolls, and on others the work rolls are driven so as to divide the work up between the tension reel and the work rolls.

As to the steel which is rolled, we find that almost every conceivable specification is being met by the products being rolled. These steels vary from the softer low carbon steels to the high carbon and alloy steels in various widths and gauges.

"Roll Oils" are introduced into the finishing process of steel strip for several reasons. The primary object is to minimize friction between the strip being rolled and the work rolls of the mill. The oils thus used form an oil wedge and act in many ways as a lubricating oil does in the pressure area of a sleeve bearing. As the strip attains its final gauge and goes to the coiler, the roll oil must provide a protective coating on the strip so that there will be practically no surface to surface friction between the turns of the coil, should there be a tendency for the coil to loosen and unwind, as this would tend to scratch the surface.

"Roll Oils" might be grouped under three main classifications, namely, (1) Animal and vegetable fats, (2) Mineral oils, and (3) Blended oils. Animal and vegetable products have certain characteristics which make them more desirable for some applications, the more important being their adhesive qualities and ability to spread over the surface of the strip, while on the other hand they have fairly high carbon residue values and tend to become rancid, and when cost is considered these are among the higher priced products. Mineral oils vary in many ways, but in general are better coolants, have lower carbon residue values, are fairly chemically stable, and are usually less expensive. Various blended oils have proven successful because of the characteristics which can be obtained by the combinations. In some cases the mineral oils have been blended with animal and vegetable fats, synthetic fats, and chemicals to get the desired results. Probably the most popular vegetable oil which is used for cold rolling is Palm Oil, although other vegetable oils have been used with limited success. The more common compounding agents which are blended with mineral oil are tallow, degras, lard oil, elaine oil, castor oil, rape seed oil and peanut oil; all of which form fairly stable products. Soluble oil, which is purely a combination of mineral oil and a saponifying agent, has become one of the leading roll oils as the mill speeds have been increased.

Our experience has been that very few rolling operations call for the same roll oil because of some difference in rolling practice, and find it necessary to carefully study each application before making any recommendation, and for this same reason we can only give a rather general discussion of the subject. Rolling speeds; type of steel rolled; width of strip; gauge of strip; type of mill; size of work rolls; and many other factors have a great deal to do with the selection of the proper roll oil.

Rolling speed is probably one of the more important determining factors in the selection of a roll oil. For example, a strip being rolled at a speed under 100 feet per minute would call for an oil having high film strength and probably a certain amount of coolant. On the other hand, a strip being rolled at 900 feet per minute would require a great amount of coolant and probably would require little film strength.

The type of steel being rolled would also be a factor for consideration and would in many cases govern rolling speeds. Also, since it seems to be generally accepted that the metal actually flows when passing through the mill, and the make-up of the metal will cause it to flow accordingly, we believe that this is a very important point to study. The physical structure of the metal forms different surface densities and requires different protection. Our biggest problem is where the kind of steel rolled is continually being changed, and where we have to choose a roll oil either for average conditions or the worst condition.

Wider strip calls for an oil which will spread more uniformly over the surface. Also, with heavier gauge strip the draughts are usually greater with roll pressures during rolling proportional.

The use to which the steel is put after finishing is a vital factor in many instances. When a certain type of strip is to be enameled, lithographed or otherwise coated, it is necessary to use a roll oil which will either clean off easily or allow the process to take place properly.

Today "Economy" is foremost in the minds of the leaders of the Iron and Steel industry, and above all a roll oil must be economical from all angles as it figures materially into the cost of producing steel.

Roof Temperature Control of Open Hearth Furnaces

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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE MEASUREMENT of open hearth roof temperatures has been made possible by the development of the radiation type of temperature measuring equipment. These units are capable of measuring temperatures at a reasonable distance and do not require to be in actual contact with the hot body like the thermocouple type of equipment. They may be protected with a water cooling jacket without introducing any errors in the temperature reading. Thus they are capable of measuring the high temperatures encountered in open hearth roofs and require a minimum of maintenance.

ROOF TEMPERATURES

Temperatures measured on the outside of the roof or between the roof brick and the insulation give very little indication of actual temperatures of the inside surface of the brick. The heat lag through the silica brick is so great that destructive temperatures may exist on the inside surface of the roof for long periods before being indicated on the outer surface. The temperature inside the furnace may be higher, at times, than that necessary to melt the brick, but unless it persists long enough to penetrate a considerable depth into the brick damage seldom results. Damage is caused by a temperature-time effect in which the brick passes gradually through a softening stage. The higher the temperature, the shorter the time required. More roof damage occurs during the working and finishing stages of the heat because of the high temperature of the roof mass. However, much damage may occur during the melting down stage, especially if a pile of scrap deflects the flame directly against the roof.

The heat penetration or soaking temperature is the most important when considering roof control. Results have demonstrated that the soaking temperature measured in the brick approximately one inch from the inside surface is adaptable to roof temperature control.

ROOF LOCATIONS

It is impossible practically to measure the soaking temperature throughout the total area of the roof. Temperatures taken simultaneously at different locations has demonstrated that the inside surface of the roof tends to become uniform in temperature from flame radiation, unless the flame impinges directly on a local area; also that the hotter areas were not necessarily in the same location during each heat. Consequently, one installation in the center of the roof has been adopted generally. The soaking temperature of this location is used as a relative guide to protect the hotter areas, such as over the tap hole, along the back wall, or the outgoing end.

ROOF INSTALLATIONS

A special sighting block in which the soaking temperature is measured is installed in place of the silica roof brick. The thermotube, protected by a cooling jacket, is mounted above the block and definitely lined up so

M. J. BRADLEY

that any shifting of the roof does not disturb the relationship of the thermotube and sighting block. Provision is made to protect the equipment in case of roof failure, and a walkway is usually provided above the roof to the installation. The indicating and recording controller is mounted across the charging floor in a position visible from any location in front of the furnace.

ROOF CONTROL

The control equipment can be arranged to function in several different ways. For instance, it may operate throughout the total fuel supply either increasing or decreasing the fuel automatically to maintain the temperature point the first helper sets on the controller. In the usual method, however, the first helper has complete control over the fuel supply except when the furnace becomes so hot that the soaking temperature exceeds the set limit, at which point the control comes into operation. The control may then cut off all the fuel, which warns the first helper that the roof is getting too hot, or it may cut back only a part of the fuel until the temperature drops to the lower set limit and then

turns it on again at the original volume. For instance, on furnaces being fired with coke gas and tar, only the coke gas is cut off; when oil is being used only a part of the oil is cut off; on producer gas fired furnaces, the steam is cut back at the producer. On furnaces equipped with combustion control both fuel and air are cut back. Most first helpers use the indicator as a guide and regulate the fuel carefully so that the temperature remains just below the set point. Thus the control acts as a safety device to protect the roof in case the first helper is so busy on other duties that he forgets to reduce the fuel.

ROOF CONTROL RECORD

The control instrument not only furnishes a continuous indication of the temperature conditions for the guidance of the first helper in operating the furnace, but it also supplies a continuous temperature record chart. This enables the Superintendent to see how the furnace was operated by each first helper. It also gives an indication of the state of the heat when one shift turns over the operation of the furnace to the succeeding shift. It shows clearly delays which require the fuel to be off the furnace as well as the stages in the heat when the roof was subjected to extremely high temperatures. It furnishes an accurate time log between charging and tapping each heat.

ROOF CONTROL SUMMARY

The maintenance required on roof temperature control equipment is exceedingly small. It takes from five to ten minutes daily of one man's time to change the charts, add ink to the pen and make occasional inspection and checking. In terms of dollars and cents the maintenance cost runs in the neighborhood of seven thousandths of one cent per ton of steel produced. Many units have been in operation over two years and to date not a single thermotube has been destroyed or returned for repairs.

On insulated furnaces, the first helper has a tendency to play safe, and so operates the furnace at a lower temperature in order to protect the roof. However, the protection afforded by roof temperature control enables him to run the furnace close to the maximum safe temperature continuously, which results in a shortening in the time of heats and an increase in production per hour. In some cases this improvement has resulted in an increase around twelve percent in production per hour and an increase of around fifteen percent in length of roof life over previous campaigns. Similar results have been reported from installations on uninsulated open hearth roofs.

Welding and the Iron and Steel Industry

By E. W. P. SMITH, Consulting Engineer
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

E. W. P. SMITH

▲ THE STEEL MILL is organized for profit—therefore increased welding means more steel used (both rolled shapes and electrodes). This is from the fabricators of steel users' viewpoint. But increased steel production is not the whole story—Reduced costs are also sources of profit. The criterion is—

Service Life divided by the Cost

Service Life of equipment means not only the time of use but also the output of equipment. Output at low cost is vital—that is a low cost per unit of output. Welding increases the actual time of use and also aids materially in increased output.

Costs are not only first cost but operating costs as well. A high initial cost may result in low total cost such as maintenance and etc. Welding increases service life and reduces costs.

The application of welding is varied which may be roughly divided into two general parts:

(1) The substitution of welded steel for other methods—Load conditions being judged by the

other methods of construction. This in general is not as satisfactory as the

(2) method which is designing directly for welding from known loads condition.

In applying welding it is well to go back to the service life—

What has equipment got to do?

Study the requirements. Select the most suitable materials. Then study the application of welding. Modify the materials and the general construction if necessary, keeping in mind the items outlined above. All problems should be considered on this basis.

We have in the steel mill repairs or modification of the existing parts as

Plate in bottom of charging box
Sides for " "
Cast ends
Reinforcing sides
Repairs to racks (teeth)
" " wobblers

We have design in steel only.

The design in steel plus small castings.

We have the design with Hi-tensile steel with or without casting.

The Design with 2 or more special metals as stainless steel and etc.

Then comes the question of what is available in rods and the application of these electrodes. The usual steel rods are considered and the special alloy and hard surfacing rods.

Then we may look to the future to see what can be done and what are the present problems.

Oil Flooded Bearings for Roll Necks

By J. H. HITCHCOCK, Engineer
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ SINCE THE INTRODUCTION of Morgoil bearings, rolling mill engineers have shown considerable interest in the theory of perfect oil-film lubrication. For this reason it is probably unnecessary to discuss here the theoretical considerations underlying their design. However, for the benefit of those who are not yet familiar with the construction of the bearings, it may be worth while to describe briefly their principal features.

The cross-section of a typical Morgoil bearing is shown in Fig. 1. It will be observed that the bearing includes an inner race, or sleeve, which rotates with the roll neck. This sleeve is made of heat-treated forged steel, and serves as the bearing journal. It is constructed with a flange at its outer end which constitutes the rotating member of the thrust bearing. The sleeve itself is carried in a steel bushing lined with centrifugally-cast babbitt, while the thrust flange is placed between two stationary steel thrust rings, having centrifugally-cast babbitt facings. All of these operating parts are enclosed in a cast steel casing which is provided with seals to exclude water and dirt. The bearing assembly is held in place on the roll neck by the conventional method employing a lock nut and a threaded split ring. The bearing is easily applied to and removed from the roll neck as a unit, without separation of the assembly, so that the highly-finished operating parts are always protected against dirt and injury.

During operation of the bearing, oil supplied by a circulating system is introduced between the sleeve and bushing in such a manner that the bearing surfaces are always separated by an unbroken film of lubricant. Oil is also supplied to lubricate the double-acting thrust bearing, as well as the roll neck itself. After leaving the bearing surfaces, the oil flows into drain pockets at the bottom of the casing and is returned through drain pipes to the oil reservoir. In order to insure perfect lubrication even with a very thin oil film, the outer surface of the bearing sleeve is ground to a mirror finish, while the babbitted bearing surfaces are finished to precision dimensions with a diamond tool. This precise workmanship enables our bearings to carry extremely heavy loads without metallic contact, and with coefficients of friction varying from .001 to .003.

From the construction illustrated in Fig. 1 it will be clear that each bearing is capable of carrying axial thrust loads in either direction. For this reason the bearings on the working side of the mill only are clamped to the roll housing. These bearings may be clamped in a fixed position with respect to the housing, or if axial adjustment of the roll is required to align passes, the bearings may be held in place with adjustable clamps. The bearings on the drive side of the mill are not clamped to the roll housing, but are left free to float as required by expansion and contraction of the rolls. The thrust

Figure 2 shows first installation of Morgoil Bearings on continuous hot strip roughing mill.

Figure 3 shows a set of Morgoil Bearings for a Four-high cold rolling mill.

rings in the latter bearings serve to locate the bearing casings with respect to the roll necks, thereby avoiding the need for any other form of tie between bearings.

The bearings are constructed in two different types. The straight-neck type bearing described above and illustrated in Fig. 1, was developed in September 1933. It employs a cylindrical roll neck and a bearing sleeve having a uniform bore. In this bearing the sleeve is mounted on the roll neck with a sliding fit, and creeps around the neck very slowly as they rotate. In the other type of Morgoil bearing, a tapered roll neck is employed. In this case the bearing sleeve is constructed with a tapered bore and is keyed to the roll neck.

Among the numerous applications of our bearings there are several which merit particular attention. The continuous hot strip roughing mill illustrated in Fig. 2 represents the first installation of the bearings in actual practice. These bearings were installed early in 1932, and have assisted since that time in the production of more than 400,000 tons of steel strip, including a considerable proportion of stainless steel. Inasmuch as the rolling practice in this pioneer application is unusually severe, the consistently flawless performance of the bearings since their installation is especially gratifying.

Our bearings were installed in another continuous hot strip mill early in 1933, replacing conventional grease-lubricated brass bearings. The results obtained in this installation are particularly noteworthy, because of the fact that very accurate records of production and cost were kept both before and after the application of Morgoils. In addition to power savings ranging from 45 to 60%, as compared to their previous practice on the same rolling schedules, the operators credited the bearings with an increase of 1½% in the average yield.

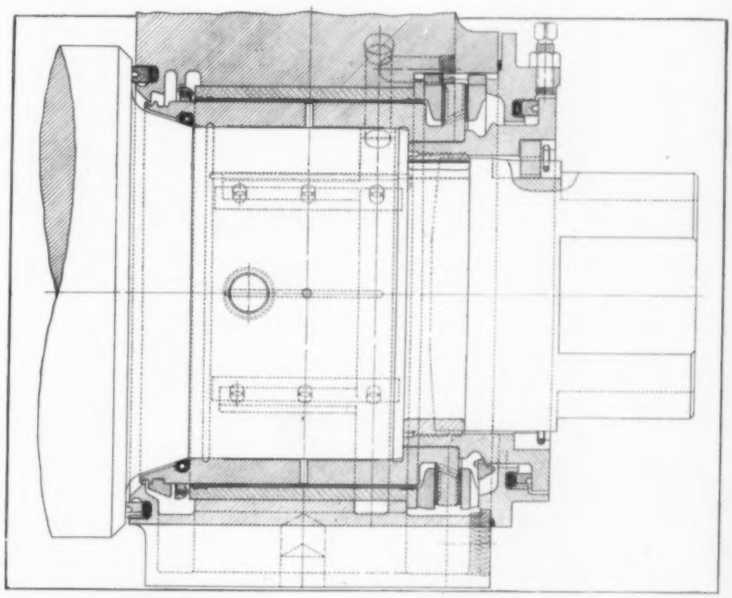
An interesting application of straight-neck bearings is found in an 18 inch two-high cold mill used for the dry rolling of brass strip. Here one of the principal requirements is that the bearing lubricant must be restrained positively from reaching the surface of the rolled strip. The success of this application throughout two years of operation indicates the effectiveness of the oil seals and drainage facilities employed with the bearings.

A few weeks ago a new rod mill was put into operation, equipped with our bearings throughout. The elimination of unnecessary frictional losses enables this mill to roll two simultaneous strands of No. 5 rod from 2 inch billets with a total power consumption of less than 80 kilowatt hours per ton of product.

One of the advantages of our bearings was demonstrated clearly a few months ago in a two-high reversing hot strip mill of the Steckel type. This mill, originally equipped with roller bearings, was changed over to our bearings in order to provide adequate bearing capacity without sacrifice of roll neck strength. The use of our bearings, although offering no noticeable power saving in comparison to the previous practice, permitted the roll neck diameter to be increased greatly, thus removing the hazard of neck breakage and eliminating the sole obstacle to the profitable operation in this mill.

The smallest bearings which have been constructed are operating on the roll necks of an 8-inch two-high cold rolling mill. This mill, which was previously equipped with bearings having insufficient capacity, produces high-carbon and stainless steel strip. Since the application of Morgoils, no difficulty has been experienced in following the desired rolling schedules.

In Fig. 3 is shown a set of comparatively large bearings which have been operating for more than two years on the backing rolls of a four-high cold rolling mill. This mill produces sheet steel in widths up to 55-inches, and is loaded very heavily in relation to the roll diameter.



(Fig. 1)—Cross Section view of Morgoil Bearing.

Morgoil Bearings are constructed for rolls of all sizes from 8 inch to 56 inch diameter. From the standpoint of theory, there is no factor which defines any limit to the life of these bearings and, in every application, they may be expected to carry capacity loads continuously for an indefinite length of time without replacement and with a minimum of frictional loss. That theory will be borne out in practice is clearly evidenced by nearly 4 years of successful operation on the original installations.

Laminated Steel Mill Bearings

By H. F. HORNE
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935

▲ LAMINATED BEARINGS are universally applied to practically all types of rolling in the Iron and Steel Industry as their remarkable advantages gain recognition among operating men. Frequently, a new product can offer one or two good reasons for its existence, but seldom such pronounced and almost revolutionary advantages as are admitted for non-metallic bearings: power savings ranging from twenty-five to fifty percent, elimination of grease and the cost of applying it, more accurate holding of gauge, reduced number of trial bars when rolls are changed and—as a conservative estimate—twenty to forty times longer life than metallic bearings.

H. F. HORNE

In a general way, the same advantages are inherent in the various modifications of laminated bearings as manufactured by Westinghouse and its several competitors, so that in many cases the sole means of judging between them is the length of service an individual bearing will give. This has been improved during the last two years to a remarkable degree. As an example, a skelp mill operating in the Pittsburgh District was quite satisfied with an average life of eighteen thousand tons on heavy fabric bearings. With the introduction of the latest type Micarta bearing, this life has been raised until from three to four times this tonnage is now consistently obtained. This example is not a freak as other types of mills have shown approximately the same average ratio.

Tracing briefly the various steps in the development of Micarta bearings, many steel men will recall the "on edge" construction of about four years ago. This type was a vast improvement over lignum vitae or metallic bearings and operated entirely satisfactorily for comparatively light pressure rolling such as encountered on rod mills. However, many jobs caused crushing and fracture of the laminations resulting in rapid failure. The heavy fabric bearing was the next change. This again was a major step forward, and many bearings of this type are manufactured and used today. In the process of research and development, however, the Westinghouse Company advanced an entirely new basis of bearing manufacture. The process consisted of altering the physical properties of the synthetic resinoid prior to the impregnation process. In order to incorporate as great a percentage of resin as possible in the bearing, resort was again made to a finer fabric, and the ultimate product was an improvement over any other bearing made in the ratio already alluded to. The long life of this bearing, of course, results in less frequent "screw downs" and test bars.

Many experiments have been run employing graphite and other so-called self-lubricating agents impregnated in the bearing. In no case, where the recommended lubricating means have been adhered to, have these graphitized bearings shown any frictional advantage. There is, on the contrary, a decided weakening of the laminated structure which results in much more rapid failure.

Practically every type of iron and steel rolling has been successfully accomplished with Micarta bearings, showing considerable power savings and other advantages. A few applications such as cold sheet mills still offer some problems which have not been entirely solved, but development work is being continued on these lines. All of these developments point to worthwhile savings in the cost of mill operations. It is decidedly to the advantage of every mill superintendent to investigate Micarta bearings. Their adoption will result in economies which cannot be overlooked.

GILBERT SOLER

Factors to be Considered in the Insulation of Open Hearth Furnaces

By GILBERT SOLER
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE USE of open hearth insulation has been spreading rapidly. Many steel plants are advantageously operating insulated furnaces. Successful insulation is not solely dependent on the application of a barrier of insulating material but many other factors must be considered, such as type of insulation, furnace design, type of fuel, flame and draft control, furnace practice, and the human element.

ADVANTAGES OF INSULATION

There are several advantages to be gained by insulating open hearth furnaces. Fuel savings of from 5% to 15% can be realized from completely insulated open hearth furnaces. Heat losses due to conduction through the refractories and infiltration of cold air and its tendency to reduce checker efficiency can be materially lessened.

Greater refractory life is obtained with insulation; especially in the case of silica brick. Less spalling is likely to occur due not only to less heat shock but also to maintaining a more uniform temperature throughout the brick, resulting in a lower differential expansion.

Time of heat from tap to tap can be reduced as much as 4% due to faster melting and less chilling effect from tap to charge. This saving in furnace time reflects in greater tonnage, lowered refractory cost per ton, and higher yield.

In some cases the scrap iron content of the charge can be increased with a resultant saving in cost of raw materials due to the favorable differential in the cost of scrap over pig iron.

Other advantages may result from insulation such as decreased slag pocket deposits, better combustion control, and cleaner tapping. During short periods of shut-down, insulation will reduce the amount of fuel necessary to keep the furnace hot.

SELECTION AND USE OF MATERIALS FOR INSULATION

Many insulating materials are available, but the most economical and satisfactory insulation project will be realized when the material is selected not only according to its physical properties but also according to the service conditions to which it will be subjected.

Different types of insulating materials must be used and applied differently on various parts of an open hearth furnace, depending on the construction of the furnace. The regenerators, fantails, slag pockets, uptakes and downtakes, endwalls, backwall, frontwall, and roof each require special treatment.

EFFECT OF INSULATION ON FURNACE OPERATION

All furnaces that have been insulated have not shown a decrease in fuel consumption. Since it is known that insulation will reduce heat conduction losses, the cause of this condition is not to be found in the insulation itself but in the effects the insulation has produced on furnace operations in regard to temperature, fuel and air in-put, drafts and velocities. Unless the fuel and air in-put is adjusted to compensate for these changes, not only is the fuel efficiency unaffected or actually lowered, but higher temperatures may prevail and thus the safe temperature limits of the refractories may be exceeded. Combustion and operating conditions will be changed when a furnace is insulated and intelligent care must be exercised in making adjustments and compensations.

Each furnace insulation project will require special treatment depending on the specific conditions involved.

FURNACE OPERATORS MUST ADJUST THEMSELVES TO THE NEW CONDITIONS

The successful solution of the problem of open hearth insulation is largely dependent on the cooperation and training of furnace operators. The changes in furnace operations produced by insulation should be explained to the furnace operators in their own mill language, for without their interest and cooperation no open hearth insulation project will be successful.

Processing Flat Rolled Steel Products

By R. J. WEAN, President
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE VERY GREAT VARIETY of requirements demanded from producers of flat rolled products forced and brought about the development of new processes and treatments of steel strip and sheets that a few years ago would have been considered impossible.

The automotive industry has without a doubt made the greatest demands on the flat steel producers. The modern design of automobile requires steel with drawing qualities and surface conditions that were not obtainable a few years ago. Turret tops as well as multiple press work, require widths and lengths of sheets with improved ductility and free of stretcher strains. Parts made from these very large sheets would show the slightest defect; therefore, the purchaser's specifications are very severe. Development of machinery for preventing the formation of stretcher strains as well as the development of strip processing equipment to accomplish the same results have been a powerful factor in making it possible to use these extremely large sheets without strains or surface blemishes.

R. J. WEAN

A. N. OTIS

Bright Annealing of Sheets and Strip in Electric Furnaces

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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE INCREASING NUMBER of continuous mills, for producing sheet steel in the form of cold reduced strip, has required a re-study of heat-treating methods, since it has been found that this cold reduced material responds to heat treatment differently from hot finished sheets produced by former rolling methods.

The demand for better physical properties, to meet the severe forming operations now required of sheet steel, have imposed conditions that are often difficult to meet.

By careful control of the rolling and other steps in the process of manufacture, some metallurgists are able to produce deep drawing sheets of fine grain structure, by a single heat treatment (anneal), having properties equal to normalized sheets. Others prefer to normalize, as giving better assurance of grain refinement, and furthermore, it is questioned whether a single high-temperature heat treatment (normalize) or a single low-temperature heat treatment (anneal) will give the

required properties, or whether a double treatment, (normalize and anneal), is desirable.

The continuous method of heat treatment—i.e.: of a single strand, is very attractive, due to the short time in process—only a few minutes as compared to about a week with box anneal—but the bright surface must be maintained in order to avoid pickling, and the surface must not be marred by the handling equipment. These operations can probably be performed satisfactorily, but it is questionable whether good physical properties can be secured consistently by this method. A series of tests have been conducted in an attempt to determine the properties that might be expected. The results of these tests will be presented. Unfortunately, they have not been consistent, and it is this point that will be emphasized, and discussion invited.

Bell-type electric furnaces—cylindrical for annealing coils, and rectangular for annealing sheets—offer opportunity for remarkably close temperature control and uniformity of distribution. This, in conjunction with control of preceeding steps, should give complete control of grain size, and drawing properties.

The heat treatment, one of the most important but one of the most crudely performed of modern mill operations, is now receiving the consideration it deserves, as evidenced by several large installations of electric furnaces for auto-body stock, now in the construction stage. Brief reference will be made to these, also to time cycles, cooling rates, etc., obtainable in various types of furnaces.

Cutting Fluids for the Steel Mill

By W. H. OLDACRE, Director of Research
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THERE IS AN AWAKENING appreciation of the importance of cutting fluids and the part they play in the machining of metals, particularly steel. Machinability is vaguely defined but always sought for. The right cutting fluid may make the difference between good and poor machining.

In the past the cutting oil man has not rated very high. Perhaps there has been good reason for this. We have known so little about cutting oils that we did not dare to confess our ignorance. Dealing with complex machining operations involving varying conditions of speed, metal, tool grinding, tool hardness, work hardness, lubrication and machine conditions, and in addition the always uncertain human element, it is no wonder that the cutting oil man frequently has been forced to use more psychology than science.

Fortunately this situation is rapidly changing. Within recent months there has been a steadily awakening interest in cutting fluid problems. Engineering societies, notably the American Society of Mechanical Engineers, and the Society of Automotive Engineers have given considerable time to discussions of these matters and have definitely laid out research programs. Skilled investigators, Boston of Michigan, Herbert in England, Schwerd in Germany, Ernst of Cincinnati, and many others have made accurate scientific studies and delivered illuminating reports of their conclusions. The work done on Extreme Pressure lubricants has thrown considerable light on one phase of the cutting oil problem. Testing machines such as the Mougey, Almen, Timken, Cornell and others have been developed and have enabled us to recognize certain definite properties. Among these is that property variously spoken of as load carrying, anti-scuffing, or anti-welding, and in controlling which sulphur seems to play such an important part. In this connection it should be said that this is only one factor in the cutting fluid problem and that consequently machine tests cannot be taken as criteria of cutting oil quality.

It is needless to more than mention to steel men the different types of cutting fluid. We are all acquainted with lard oil and lard oil mixtures, which have been used as cutting lubricants since the beginning of the industry. Blending and substituting less expensive fats for lard oil was for many years almost the sole function of the cutting oil manufacturer. Among consumers there are still a few faithful lard oil fans. The development of sulphurized and sulpho-chlorinated cutting oils has been a real achievement of the cutting fluid engineer. Generally speaking, sulphurized products are inexpensive and highly efficient. High speed machining of stainless steels and other tough stringy alloys would be almost impossible without them.

We have mentioned before the fact that testing machines developed for testing extreme pressure lubricants have thrown considerable light on the function of sulphur in oils. It is strange that some of our old-time blacksmiths didn't help us out long ago, for he has long known what these machines have only recently demonstrated:—that sulphur acts as an anti-weld. It is very difficult to weld iron or steel in the presence of sulphur.

In the highly stressed metal around the cutting point high temperatures and contact pressures are developed. These pressures and temperatures tend to make the

chip weld to the tool with consequent damage to the tool and rough finish on the work. Sulphur in the oil tends to prevent this welding. In addition the cutting fluid lowers temperatures by reducing friction and by absorbing and dissipating the heat.

There has been considerable conjecture as to the manner in which the fluid reaches the almost inaccessible point of contact between the tool and work. Kingsbury held as early as 1895 that the cutting fluid was drawn into the space between the bottom of the chip and the face of the tool as a result of the partial vacuum formed in the crack, which precedes the point of the tool. Bingham emphasized the part that the adhesiveness or wetting qualities of the fluid played in causing it to follow the metal surfaces to the contact point even under adverse conditions. Most recent investigators question Kingsbury's idea of a crack ahead of the tool point. However, the action at the point of the tool is a pulsating one with alternating cycles of compression and expansion and it is not at all impossible that this pulsation "pumps" the oil, or oil vapor, into the interstices of the chip and tool structure.

A large part of the output of our steel mills must be machined into its final form. The problem of cutting fluids is therefore of vital importance to steel men. The Association of Iron and Steel Electrical Engineers is perhaps more interested in machining problems in the mill than in the plant of the consumer. Threading, drilling, turning and drawing operations generally call for special lubricants. Closer contact between your plant and the cutting oil engineer will pay big dividends We ask your co-operation. Don't delegate your next cutting oil test to someone who will take an operator's word for results. Give it your personal attention—consult with the engineering representatives of responsible cutting oil manufacturers. Treat it as the scientific engineering problem that it is. You may be pleasantly surprised at the amount of real information available and the increased efficiency which will result.

Roll Table Equipment for Wide Strip Mills

By G. A. CALDWELL and S. F. HENDERSON
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE MODERN wide strip mill is usually designed to produce coiled strip, sheets and plates. Each product requires different handling upon leaving the last stand of the mill and these operations must be performed efficiently and rapidly so that the output will not be restricted by the handling equipment. This equipment consists of pilers, coilers, shears, levellers, trimmers, etc. along with the necessary roll tables to convey the steel from one unit to the other.

To provide sufficient handling room several hundred feet of roll tables are required. On these tables, the use of bevel gearing has been eliminated and individual motors of the squirrel cage induction type are used to drive each roll or pair of rolls either direct connected or through suitable gearing. On a mill now being installed approximately 900 motors will be used representing a connected load of 2600 HP. On the mills in this country placed in service during the past year and those which will be installed during the coming year approximately 4000 motors will be required representing a connected load of more than 10,000 HP. It is evident that the roll tables are a large item and a very important one. They are being given very careful consideration by the steel producer, mill builder and the electrical equipment manufacturer.

Most of the earlier installations of individual roll table motors were driving small rolls running contin-

G. A. CALDWELL

S. F. HENDERSON

uously at constant speed and the motors were usually rated 1 HP. or less. The present wide strip mill not only requires a long heavy roll, but also requires that at least part of the motors be capable of rapid acceleration and retardation. Naturally the size of the motors has been greatly increased and a mill now under construction will have some rolls that will be driven by 10 HP. motors. The motors are supplemented by suitable control equipment and, when adjustable speed tables are required, by motor generator sets consisting of an A. C. synchronous generator driven by a D. C. adjustable speed motor.

To obtain the least expensive installation capable of performing a definite service, it is necessary to apply and design the motors, control and variable frequency generator sets for the most efficient use of the combination. It is not sufficient to consider each item separately. For example, on adjustable speed tables, the simplest control equipment would start the tables by connecting the motors to the A. C. generator with the M. G. set running at the desired ultimate speed. The motors also would be stopped by plugging. However, such a layout would require the largest motors and variable frequency sets with a cost far exceeding that of an installation where the proper refinements have been made in the control equipment.

When frequent starting and stopping is required, the size of the equipment is determined by the torque required to give the desired rates of acceleration and retardation and by the ability of the equipment to dissipate the losses generated during that part of the cycle. The load on the motors after reaching the operating speed is only the torque necessary to overcome friction and is small compared to the torque required for acceleration. Neglecting the friction load, the heating in the motor rotor during acceleration to a definite frequency is equal to the kinetic energy added to the system and is not influenced by the motor design except as it affects the total inertia. Likewise the loss during the plugging is not affected by motor design, but is much greater than the loss during acceleration. The loss in the stator is a function of the design and by proper consideration of the application can be kept to a minimum.

On a continuous running application, the losses during acceleration are not important because they occur at such very infrequent intervals. However, on the modern installation where the motor starts and stops as often as twice a minute, they are extremely important. By proper application of certain fundamental principle these losses can be materially reduced. In the paper, we will discuss the various factors of design and application of both the motors and motor generator sets, and present the methods used in controlling these units to give the duty cycle performance required at a minimum expense.

Development of Specifications for Lubricants

By O. L. MAAG
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ MODERN STEEL MILLS offer perhaps the widest range of lubrication problems presented by any industry, and the increasing use of anti-friction bearings makes the importance of proper lubrication a subject of vital interest to both operating and maintenance staffs. Lubricants used in steel mill anti-friction bearings must act to:

1. Avoid internal friction in the bearing by preventing metal to metal contact.
2. Dissipate heat.
3. Prevent rust and corrosion.
4. Aid in keeping out foreign matter such as water, scale, etc.

Heating may be caused by overloading, transmission of heat from hot material being worked, the wrong consistency of lubricant, etc. Corrosion may be due to the use of a lubricant not up to standard specifications, and the chemical laboratory can be of great assistance to the operating and maintenance departments by testing

the lubricants. Specific gravity, flash and fire tests, cold and pour tests, viscosity, and consistency are all subject to standard tests, briefly described and their purpose and value discussed, as is also the purpose and use of the mechanical lubricant tests for checking load carrying capacities, stability, and abrasive properties of all kinds of lubricants.

Causes of lubrication difficulties are outlined, such as thinning and foaming, chilling, wrong consistency, too much lubricant, etc., and suggestions as to how these difficulties may be overcome and avoided are presented.

Following a brief but comprehensive discussion of the methods of lubrication commonly used in steel mills, the properties of various kinds of lubricants are discussed in considerable detail, with particular attention to E. P. lubricants. Data are presented on the relation of film strength to viscosity, and on the load carrying capacity and abrasive properties of certain chlorinated oils and sulphurized fatty oils.

Recommendations for the type of lubricant for various mill bearing applications are presented, together with specifications covering both general machine and heavy duty applications. These include water resistance, corrosion, moisture, separation, flash, fire, and viscosity, and for heavy duty, pour and load carrying ability. A series of detailed tables is also given covering operating temperatures below 32°F., 32°-125°F., 125°-180°F. and above 180°F. for bearing sizes above and below 6 inches O.D. and indicating the recommended type of lubricant and its viscosity or consistency under conditions subject to or without moisture.

Progress in the Use of Composition Bearings

By K. T. MacGILL
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JOSEPH T. RYERSON & SON, INC.

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ IN JUNE of 1932, I had the privilege of talking to this group on the subject of composition bearings under the heading of "Reducing the Bearing Cost Per Ton of Steel Rolled". At that time, the thought of using a laminated synthetic resinous type of bearing for roll neck bearings was a new idea to most of the men present.

Today, I would venture to say that there is not an engineer or operating man present who has not had actual experience with composition bearings and who has not personally seen in actual practice, the advantages which can be derived from their use.

In '32, composition bearings were used mainly in the smaller high speed mills. Now the composition type of bearing is in use in practically every type of rolling mill equipment with the possible exception of hot sheet mills where the temperatures on the barrel of the roll are from 700 to 800 degrees F., which is too hot to permit satisfactory bearing operation, with water for a lubricant.

It was thought in the beginning that water lubricated bearings would not function on slow speed roll necks; now, installations are common in such applications as reversing blooming mills and No. 1 roughing stands in continuous mills where the speeds may be considerably under 100 surface feet per minute on the surface of the roll necks.

In '32, it was a mooted question as to whether the water served only as a coolant or formed a film as an actual lubricant.

Experiments with dry ice as a coolant, perforated bearings with the holes from the bearing surfaces connected to long glass tubes and also composition shafts running inside of glass bearings have shown visibly and beyond further argument that a lubricating film is formed and maintained under varying speeds and pressures, when water is properly applied.

The question of permissible bearing pressures is being answered by actual installations. Bearings are in service which are working under a loading estimated to be as high as 10,000 pounds per sq. inch. This application, however, is not a rolling mill.

Maximum rolling mill pressures are probably reached in the large backing up rolls on 4-high mills, but these pressures are well within the safe load carrying range of the laminated synthetic resinous type of bearings, and such installations in both continuous and reversing types of mills are proving their ability, after six months service, to work satisfactorily under these conditions without any appreciable change in motor load or qualty of material rolled, and at a very moderate first cost.

The advantages of the use of composition bearings in four high mills are many—perhaps one of the most important, the diameter of the roll neck can be increased 25% or more, thus reducing unit bearing pressures, increasing bearing life and providing a more rigid roll and increased roll life. Under proper operating conditions, the roll neck temperature remains constant at about room temperature which makes for rolling to closer tolerances and fewer mill adjustments.

K. T. MacGILL

The range of application for composition bearings covers practically every mill bearing where water can be used for a lubricant. At this time, we might say, almost regardless of speeds or pressures. The benefits from the use of these bearings in particular as compared to bronze or babbitt bearings, are summed up briefly in—

reduced power consumption
oil saving thru water lubrication
ability to roll to closer tolerances
longer bearing life
fewer mill adjustments
safer operating conditions

In the manufacture of the bearings themselves, many changes are taking place, improvements in materials are giving harder bearings with longer life and lower coefficient of friction. (Definite methods of testing bearings have been developed, so that bearings can be checked to a standard and their uniformity assured.)

The experience gained from you men who operate mills with composition bearings has permitted a definite technique to be developed in the handling of these bearings, and of their design, and the proper method of applying water to lubricate them. Your reports on bearings which have failed have been most enlightening and have shown the way to prevent a recurrence of the trouble.

It really has been surprising the few things which can cause these bearings to give trouble. They can all be classified in two general groups, headed "Water" and "Pressure".

Under "Water" is found—

insufficient quantity—low pressure
not properly directed—clogged sprays
too hot
carries too much abrasive

The answer to all water problems is found in a realization of the fact that the function of the water is to serve as a lubricating film and to dissipate the heat from the work done in the bearing.

As the temperature of the water rises, its viscosity decreases and it has less strength to serve as a separating medium between the bearing and the journal, as work done in the bearing increases, the heat to be carried away increases. It is obvious therefore that there should be flexibility in the water supply if the proper rate of heat dissipation is to be maintained with varying load conditions.

It is true many mills turn on a supply of water to take care of maximum load conditions but where the supply of water is limited or the cost is high, intelligent supervision and consideration of what the water is supposed to do will save many gallons every minute.

In the Summer, with water temperatures from 20 to 50 degrees warmer than in the Winter, and room temperatures up a corresponding amount, more water will be required than during Winter operation.

The only water which does the bearing any good is that which strikes the journal at a proper angle; loose water pipes and sprays which can get out of position have been responsible for many a lost bearing and wasted gallons of water.

Under the "Pressure" heading is found—

Bearings not properly lined up, concentrating the entire load on one end or the other may create such tremendous pressure at the point of contact that the water film cannot take away the heat and breaks down, greatly increasing the pull on the motors, and may even kick out the circuit breakers or if enough of the bearing is in contact with the roll neck, the wiping action may be so great as to break out the keeper plate bolts and turn the bearing out of the chuck.

If bearings are out of line, even a normal pressure on the end adjusting screws will also localize the entire load on a point on the thrust, and either crack the bearing in the fillet or break out the bottom of the thrust depending on which way the bearing is cocked.

With the bearing properly lined up, proper end screw adjustment is most important. The tremendous pressures used on bronze bearings applied through a long handled wrench with a pipe on the end of it are unnecessary with this type of bearing. Mills that are getting the most satisfactory service from their composition bearings have persuaded their rollers to throw the pipe away and shorten the wrench handle.

It has been our experience that where the Superintendent or Mill Foreman (who is in possession of these facts) take the proper interest in the actual use of composition bearings, much better results are obtained. Very often, when the roller can not make or loses his section, he blames the bearings when it may be any one of many things rather than the bearing, such as not enough water, rolls out of alignment, due to chucks being cocked, too loose couplings and spindles, or a bottom roll jumping, or back lash in the mill due to reduced friction load.

Very often, we find rollers taking up on side screws because mill is noisy due to freer running rolls than

with metallic bearings, thereby defeating the very purpose of fabric bearings. These things are purely mechanical and with proper care and adjustment can be overcome.

We feel that in the past three years a very satisfactory progress has been made in extending the use of composition bearings and with improved mill operations and the desire to roll sections to closer tolerances and further reduce operating costs, the use of this type of bearing should be extended very rapidly.

Welding with the Alternating Current Arc

By HARRY A. WINNE
Industrial Engineering Dept.
GENERAL ELECTRIC COMPANY

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ ALTERNATING CURRENT arc welding is by no means new. It has been known, and practiced to a considerable extent, about as long as d-c arc welding. In 1917 or thereabouts a great deal was heard of a-c welding with so-called Quasi-Arc electrodes, which were among the first of the heavily coated electrodes. Even at that early date it was recognized that a-c welding with bare electrodes could not compete with d-c, and while good a-c welds could be made with the Quasi-Arc, an electrode cost of approximately one dollar per pound prevented any wide use of the process in this country.

The comparatively recent development of low cost heavily-coated electrodes has been concurrent with the general acceptance of the fact that for high quality welding with d-c or a-c such electrodes must be used. The commercial availability of these electrodes has revived interest in a-c, and today its use, in certain fields, is increasing quite rapidly.

In determining whether a-c or d-c should be used for a given application a careful study should be made. Each has its advantages and disadvantages. A-c is by no means a cure-all, and d-c is more generally applicable.

WELDING CHARACTERISTICS OF A-C

Perhaps the principal advantage of a-c is the practical elimination of the magnetic distortion, or blowing, of the arc, which may be quite troublesome with d-c in certain applications, particularly when heavy currents are used. This feature makes possible the use of higher welding currents, and consequent greater speed, without sacrifice of quality, in some applications.

A disadvantage of a-c is that "penetration" of the weld into the parent metal may not be so good as with d-c. This is particularly noticeable in attempting to make a weld in a single pass with currents of around 300 amperes or less. With d-c the distribution of heat in the arc—between electrode and work—can be controlled by the type of electrode coating used. In a-c welding the heat liberated at work and electrode is of equal quantity, so penetration can not be controlled by varying the type of electrode.

To secure high quality a-c welds proper electrodes must be used. All covered electrodes are by no means particularly suited for a-c welding. In fact, an electrode which gives excellent results with d-c may be only mediocre or even poor as an a-c rod.

One important function of the coating on the rod is to stabilize the arc by helping to keep the space between electrodes and work ionized so that after each current zero only a low restriking voltage is required. Of two well known covered electrodes which give good results with d-c, one requires an open circuit voltage of over 95 for satisfactory results on a-c, while the other operates equally satisfactorily with only 70 volts, both at the same arc current.

HARRY A. WINNE

The higher the welding current, the more stable will be the arc, and vice-versa. Even with bare electrodes a fairly stable arc can be maintained above about 300 amperes, while welding with even the best heavy-covered electrodes below 60 amperes is quite difficult unless a very-high-frequency pilot or ignition spark is used. With a superimposed ignition circuit of around 3000 volts at one-half million or more cycles, satisfactory a-c welding can be done at currents as low as 10 or 15 amperes.

For welding currents within the ordinary range of 100 amperes and up, either 25 or 60 cycles may be used, and there appears to be no advantage, and in fact some disadvantages, in going to higher values. Below 100 amperes no gain is apparent by the use of higher frequency until we also apply the much higher voltage and frequency of the pilot spark circuit.

ELECTRICAL CHARACTERISTICS

With heavy covered electrodes the arc voltage ranges from 25 to 45 volts, depending on the electrode, and

arc current. To give a stable arc, if the electrodes are properly designed for a-c, an open-circuit voltage of 80 is ample. For some commercial types a value as high as 100 is desirable.

To regulate the arc current either resistance or reactance may be used. It is apparent that if series resistance is employed the power loss wlll be high and the efficiency poor. If reactance is used the efficiency will be high and the power factor poor. In the first case the efficiency, and in the second the power factor, will approximately equal the arc voltage divided by the open circuit voltage.

The arc tends to be more stable with reactance control than with resistance, because of the shape of the volts-amperes curve. Also because of the poor power factor a greater restriking voltage is available at the current zero.

An a-c welding transformer constitutes a single-phase load, usually at poor power factor. However, if several equipments are in use in the same plant they can be distributed on the various phases of the system, and the power factor can be corrected by using capacitors or other means.

A-C WELDING EQUIPMENT

Practically all a-c welding equipments on the market today consist of single phase transformers, stepping down from 220 or 440 volts to from 80 to 125 volts, with either adjustable resistance or reactance for regulating the welding current. The larger units all employ reactance, to eliminate the high power loss that would be incurred if resistors were used. In some the reactance is incorporated in the transformer structure, and adjusted by means of moving a magnetic shunt or changing taps. In others it is external to the transformer unit, but the effect is the same.

Some of the smaller units use resistors for current regulation.

For very low current welding a high frequency pilot spark equipment is included.

Standard ratings of commercial welding transformers are as follows:

Rated Current	Current Range Max.	Current Range Min.	Rated Arc Volts	Open Circuit Voltage
150 amp (30 min)	150	15	30	80
300 " (1 hour)	300	60	40	80
500 " " "	500	100	40	80
750 " " "	750	150	40	80
1000 " " "	1000	200	40	80

Applications of Controlled Atmosphere to Heating of Steel

By T. B. BECHTEL, Engineer
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

T. B. BECHTEL

▲ IN DISCUSSING the application of controlled atmosphere to furnace equipment it will become apparent that the subject has a very considerable scope. This will be recognized if we consider for a moment that prepared gases such as hydrogen, nitrogen and carbon monoxide have long been used in furnaces for the prevention of oxidation of the metal being heated. This is similarly the case with gaseous atmospheres such as natural gas, city gas or producer gas, modified very slightly in some cases and applied to such operations as the annealing of flat rolled products.

These gases, although they cover a rather wide field, are limited in application for engineering or commercial reasons. However, within the past few years, there has been developed a mixed gas controlled atmosphere which covers the requirements of the fields of bright annealing, scale free hardening, continuous brazing and other correlated processes in a much broader sense than was previously available. Due to the easy availability, economical production, general adaptability and reliable characteristics of this class of controlled atmos-

phere, as compared to the previously used gases cited above, the scope of application of controlled atmospheres has been greatly broadened. Hence, at the present time when we speak of controlled atmospheres we think particularly of these cracked gases. They are produced from a readily available source such as natural gas or city gas, usually from the public service company's supply mains. The equipment to produce them is comparatively simple and reliable in operation, and the product is of uniform characteristics and low in cost.

Although the development of this gas and the equipment for processing it is comparatively recent, numerous applications have already been made in the field on a wide variety of operations and processes.

It will, of course, be recognized that the majority of the uses for such atmospheres will be in the cold worked products field; that is, in the heating operations necessary thereto, more so than in the field which pertains to hot worked products. The reasons for this are of course so obvious as to require no explanation. With hot worked products, particularly those which are hot rolled or forged, in which the hot working occurs in an air atmosphere, it will be seen that full protection for the metal during the period at which it is in the scaling range is impracticable. Hence, the economic use for controlled atmosphere will be found to lie largely in the fabricating and finishing fields; more particularly on cold finished parts but also with some important applications to hot worked products.

Much has been said and printed in previous meetings of this association and in the technical publication field in general regarding the bright annealing of cold rolled strip, both in batch and continuous furnace equipment with the use of controlled atmosphere. Since this product has received so much attention and since there are now so many other applications of controlled atmosphere in successful operation in other fields, it has been considered that the description of a few of these applications would serve a useful purpose at this time. It is hoped that such applications will serve to indicate the present enlarged scope of the use of controlled atmosphere, and to give a better idea of the uses, and perhaps of the limitations also, of this new tool to serve the metal working industry.

Composition Bearings for Roll Necks and Other Purposes

By H. M. RICHARDSON
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GENERAL ELECTRIC CO.

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ IT HAS BEEN clearly demonstrated over the past six or seven years that water lubricated nonmetallic bearings can be successfully applied to heavy duty rolling mill equipment. They have been used on almost all types of rolling mills with the exception of the ordinary 2-high hot sheet mill which is not water cooled and on which the normal neck temperature is above the charring point of nonmetallic bearings.

A lot of information about the savings to be effected by composition bearings—in power—grease—roll life—increased tonnage—lower scrap loss—long bearing life—and more accurate gage—has been published in many places—and still more has been circulated by word of mouth.

These phases of the subject will not be discussed further in this paper.

Instead, let us examine some of the remaining problems connected with the application and use of composition bearings; obstacles which can be eliminated, in order to gain the fullest benefit from the use of the bearings.

One problem has been that of the amount, the purity and temperature of the cooling and lubricating water. It is well known that in some mills where the water temperature in the summer time is much higher than in the winter, the life of the bearing is shorter during the hot weather. A series of tests is being conducted to find the friction characteristics and rates of wear of Textolite bearings at various loads and speeds as a function of the temperature and amount of cooling water.

In order to get the best efficiency out of the cooling water, the spray pipes should be designed to bring as much of the cooling water in intimate contact with the neck surface as possible. This means that the jets of water must be as many as practical and that they must impinge on all of the available open neck surface. Two or three rows of holes in the spray pipes which direct the water on a large area of neck surface is much better than a single row of holes directing the same amount of water on a smaller area.

This thought also brings up an important point in the design of the bearings. From the standpoint of cooling as much of the neck surface as possible should be exposed. We have found by experience with Textolite bearings (with their lower coefficient of friction) that to maintain proper roll alignment, the arc of contact can be much less than with metallic bearings. For roll necks without side bearings, this arc of contact

H. M. RICHARDSON

can range from a minimum of 90° to a maximum of about 135°. Single stands not reversing, or stands in a Belgian type mill, will use 90° to 120°, while stands in continuous mills or reversing mills, will use bearings from 120° to 135°. On large mills with side bearings, the top and bottom bearings should range between 60° and 90°.

The purity of the cooling water is also an important factor. Acids or salts in the cooling water will often corrode the surface of the roll neck and prevent the maintenance of a smooth journal surface. This results in shorter bearing life. This effect is much more pronounced as the temperature of the cooling water rises above, say, 90° F.

Some work has been done with emulsions for lubricating composition bearings. The most promising application for emulsion-lubricated composition bearings is in cold rolling mills, or on machine tools where the emulsion can also be used as a coolant for the work.

On mills rolling shapes or rounds where it is the usual practice to hold a very tight mill, there is a tendency to rapid wearing out of thrust collars until the roller learns the "feel" of the nonmetallic bearings. It has been found by experience that often the first collars are short lived but that each succeeding set lasts longer until the life of the collars is comparable with that of the radial linings.

Another problem in the design of nonmetallic bearings is to choose the proper thickness of lining. As a rule, the thickness of lining and thrust collar is determined by the amount of material which must be machined out of the old bearing or chuck to give the nonmetallic material a good backing. This procedure is usually all right because the resulting lining thickness is not enough to add an objectionable amount of "spring" to the mill—except in the case of mills rolling thin strip or sheet. The "spring" in the Textolite bearings can be easily remembered as .002″ per thousand pounds per square inch bearing pressure per inch of bearing thickness. Experience has shown that $\frac{5}{8}$″ is the maximum lining thickness for radial bearings on hot strip mills.

Another factor which has been noticed from time to time is a certain amount of scoring on the necks of alloy steel rolls operating on fabric base composition bearings. This, we believe, is caused principally by the surface of the bearing becoming charged with abrasive material such as scale, red oxide or sand. It can be minimized by providing good scale guards over the roll necks on the stands where there is a lot of flying scale, and by keeping sand or other abrasives out of the water supply. Such scoring seldom occurs on the necks of chilled iron rolls, which are quite hard, and on relatively few steel necks. Where it has occurred, the necks have a hardness of 35 scleroscope—or less. Tests are being run now to find the minimum hardness, above which such scoring is not likely to occur.

Other applications for composition bearings—aside from roll neck bearings—have been tried and found successful. These applications fall into four classes:—

1. Water lubricated bearings—on table rolls, centrifugal pumps, etc. These applications follow the same rules to give success as for roll neck bearings—plenty of clean water, adequate provision for circulation of water, means for preventing corrosion during shut down, and journal surfaces of reasonable hardness.
2. Grease lubricated bearings which are used intermittently and are not often lubricated. An example is the bearings of the line shaft on a crane in a sheet mill. Grease must be used sparingly so no drip will fall on the finished sheets. The service is intermittent, so the heat of friction can be easily carried off through the shaft.
3. Bearings subjected to heavy impact loads in intermittent service. These are grease or oil lubricated and have an overall load-speed duty cycle which allows the heat of friction to be carried off by the journal.
4. Oil lubricated bearings with circulating oil lubrication in which the heat of friction can be carried away from the bearing by the oil and by the journal.

Through all of these applications there is one characteristic of composition bearings which acts as a limitation. That is the low heat conductivity. They can be made of materials which will withstand as high temperatures as babbitted bearings, but in all cases, the heat of friction must be carried away by the lubricant, be it oil or water, or by conduction through the journal.

Oxy-Acetylene Process in Steel Industry

By E. J. W. EGGER, Engineer
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ AMONG the divisions of the oxy-acetylene process utilized in the iron and steel industry, none enter more widely into all phases of steel manufacturing and marketing than flame cutting. Recent trends and developments are pointing toward even greater utilization of this cutting method. There are not only new possibilities for economies and improved quality in steel manufacturing, but many opportunities to widen the market for steel in the form of heavy plates and shapes, especially for welded construction.

An advancement in steel making is the wing type ingot, whose design is based on flame cutting the wings from the central portion. The ingots are cut at a bright red heat, and experience gained in this work should be valuable for other hot cutting operations.

A vast expansion in the market for rolled steel has resulted from the accuracy and flexibility of machine flame cutting, and from the fact that cut edges are left in excellent condition. Precision of machine flame cutting has been shown to be within a few hundredths of an inch for 2-in. material. The flexibility is such that plates may be cut in intricate, jig-saw patterns, where required, and in many instances the cutting machine may be taken to the work for easier performance of the cutting job. The high quality of flame cut edges has again been demonstrated in a recent investigation of the effects various cutting methods have on structural steel. The suitability of flame cutting for preparing plate edges for welding is strikingly attested to by recent revisions of the A.S.M.E. Boiler Code and the A.P.I.-A.S.M.E. Unfired Pressure Vessel Code which have always permitted flame cutting plate under 0.35 per cent carbon and which now permit welding directly on flame cut faces.

An instance of the adaptability of machine flame cutting is seen in the accurate trimming and beveling of curved or dished plates in preparing joints for welding.

The steel industry itself is making extensive use of flame cutting in marketing rolled steel. Heavy sections are flame cut to shape in the mill to avoid freight on portions that are waste and which would otherwise eventually come back to the mill as melting scrap. Maintenance work in steel mills requires many shape cut parts and new equipment is more and more being fabricated from rolled steel, flame cut and welded.

W. E. BLYTHE

Novel Type of High Temperature Conveyor

By W. E. BLYTHE, District Mgr.
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Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ IN TODAY'S treatment of steel in various forms temperatures attained have been carried up to limits that present a serious problem to the designer of conveying equipment of heat resisting alloy.

From the standpoint of the furnace manufacturer and also the furnace user there is today a wide variance between the characteristics of the three types of furnaces most commonly used for these heat treatments. These three types of furnaces are the "roller-bottom" furnace, the "walking-beam" furnace and the "chain" furnace. Each type of furnace has, of course, its specific advantages and disadvantages.

This paper contrasts briefly these three types of furnaces, but mainly follows through the development of "dry" or "alloy" shafts for the familiar "roller-bottom" furnaces over the past ten years and up through the introduction of the "inside-bearing" shaft some four years ago.

A description is given of the experimental work done on this "inside-bearing" shaft and also details of the

development of this design in two furnaces now in operation for sometime. The paper concludes with suggestions covering possible variation of this "inside-bearing" design in the construction of future furnaces.

Alternating Current Arc Welding

By E. STEINERT, Engineer
and W. W. REDDIE, Sales Dept.
WESTINGHOUSE ELECTRIC & MFG. CO.

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE QUESTION is frequently asked in discussions of arc welding apparatus, why is alternating current welding experiencing so much of a revival and increased use when fifteen years ago it received what most engineers considered a fair trial, and was set to one side in favor of direct current welding.

Three major reasons may be given: The extension of electric arc welding into fields which did not exist fifteen years ago, the development of suitable electrodes for alternating current arc welding and improvement and development in alternating current welding apparatus.

E. STEINERT

Four methods of obtaining suitable alternating current energy for arc welding will be considered: The use of simple adjustable reactors, sixty cycle generators, high frequency generators, and transformers. Two of these methods, the high frequency generator and the transformer are in commercial use today, and the transformer at least has reached the stage of commercial development and use, where, in combination with concurrent electrode development, the alternating current system of arc welding may be considered as a valuable addition to welding practice.

An alternating current transformer type welder must meet four principal requirements; first, safely insulate the secondary or welding terminals from the primary line voltage; second, transform from an economical

W. W. REDDIE

shop distribution voltage to a suitable welding voltage; third, provide a convenient means of adjusting the welding current and fourth, provide the necessary characteristics and means for the production of a stable arc.

Alternating current welders of the transformer type may be divided into three general classes, two of these classes covering a line of ratings approximately 300 amperes and below and the third covering ratings larger than 300 amperes.

The first of these classes includes primarily portable machines employing reactance control, intended for use with dusted, dipped, or coated electrodes and for use where unusually light current welding is not required.

The second class includes portable welders of ratings similar to those in class one except equipped with a high frequency oscillator circuit to improve the arc stability. This class of welder is designed for more general application in connection with either bare or coated electrodes and is particularly well adapted to

the welding of light gauge metal requiring low welding current and exceptionally good arc striking characteristics. The superimposed high frequency voltage which is applied across the arc not only provides good arc striking characteristics but makes the arc stable and easy to manipulate by maintaining a constantly ionized arc path during current reversals. This method of arc stabilization permits the use of either resistance or reactance control and a lower open circuit power voltage than otherwise possible.

The third class is comprised of heavy duty arc welders. Ratings of 500 and 750 amperes in this class are representative. This type, usually designed for stationary mounting finds its largest application in industrial shops in the fabrication of heavy pressure vessels and similar structures. The elimination of arc blow, while important anywhere, is of unusual value in work of this type on both manual and automatic applications. These welders employ reactance control and are designed primarily for use with dusted, dipped or coated electrodes.

The lower welding range required is ordinarily not below 100 amperes and arc characteristics and ease of manipulation, are good over the entire welding range, when using suitable alternating current electrodes.

During the last few years several possible methods of current control have been experimented with and tested in the field. The type employing the moving core scheme has met with considerable success because it is particularly adapted to arc welders of high current capacity and combines the advantages of the moving coil and tap-changer methods. The moving core scheme permits the use of a rugged winding fixed in position, eliminates continual switching of the electrical circuit for current adjustment, provides a means of obtaining an exceedingly fine welding current adjustment and permits adjustment of the welding current while operating.

Open circuit voltages used with alternating current welders are normally higher than used with direct current. For example with a rated open circuit voltage of 80 volts, the peak voltage at open circuit would be 113 volts. This has recommended the development of automatic and semi-automatic voltage controllers, for reducing or eliminating entirely the secondary open circuit voltage when not welding.

Three types have been fully developed and are in commercial use.

The first of these is semi-automatic and was developed for use with welders of the high frequency stabilized type. The transformer except for a low voltage pilot circuit to the electrode holder is off the line when not welding. The operator depresses an electrode holder handle switch when he starts to weld which connects the primary of the welder to the line, giving him full open circuit voltage. The switch is so arranged that it is held closed without conscious effort during welding.

A second type automatically reduces the secondary voltage to approximately 40 volts when the operator ceases welding. Striking the electrode against the work upon resumption of welding automatically restores full open circuit voltage.

A third type automatically cuts the welder off the line when the operator ceases welding thus reducing idle time losses to zero except for low voltage pilot circuit to the electrode holder handle. Momentary contact of a switch in electrode holder handle reconnects the welder to the line and it is automatically held on as long as welding progresses.

With suitable apparatus and electrodes available, the choice of or the use of both types, alternating current and direct current, will be influenced by type of work to be done and supply power conditions. The trend to more extensive use of alternating current is found at each end of the welding range, in light current work on thin sheets, and in heavy current welding in pressure vessel and tank shop work, particularly in Class I and Class II welding requirements. The light current welders may be designed for high efficiency and low power factor or high power factor and lower efficiencies. Designs thus far on the heavy current welders give the high efficiencies of transformer operation but a power factor on the order of 50%.

IRON AND STEEL EXPOSITION

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WELDING DEVELOPMENTS

DURING THE YEAR 1934 — 1935

By GROVER A. HUGHES, Electrical Engineer
Truscon Steel Company
YOUNGSTOWN, OHIO

Paper to be presented before the A. I. & S. E. E. Convention Pittsburgh, September 24, 25, 26, 1935.

▲ THE DEVELOPMENT of welding of structural members has been slow, partly by the structural engineer being familiar with only the riveted joint and not having information at hand on welded connections. A properly designed welded connection of structural sections is entirely different in appearance and is not calculated the same as a riveted connection. The structural engineer could see a rivet head on both sides of the structural sections and knew there was a connection between them. The slight depression of spot welding or the small raised spot in button welding gave them nothing to see that a union of metal did exist between the sections being joined. The metal deposited by arc welding was questioned. Reliable data of strength of arc welding or resistance welding was not at hand. To collect the data would require considerable time and expense. It was evident this information must come from the fabricating companies and the builders of welding apparatus.

The late Mr. Lamme said "The best text books for students usually are written by those most familiar with the art of teaching." So should the best technical books for the welding engineers be written by those who are in the midst of such work. Otherwise, the text is liable to lag behind the actual practice. In the welding art in our factories the growth has been so rapid since the war and the changes in practice so numerous, that only those directly in touch with the many developments are able to tell the up-to-date story. Unfortunately, it is only in rare cases the doer is the teller. That is, too often he delegates the telling of his work to others, while he continues to do. Lack of practice in writing is often the cause of this. The American Welding Society realizing this, is preparing a hand book for the welding engineer.

AMERICAN WELDING SOCIETY

The American Welding Society composed of men interested in welding has for the past fifteen years been collecting data on welding. In 1934 a revision of the code for Fusion Welding and gas cutting in building construction, Part A (Structural Steel), was published. This revised (1934) Edition contains many changes, and includes the following four appendices:

Specifications for filler metal.
Qualification tests for operators of welding equipment.
Recommended welding practices.
Weld symbols and notations.

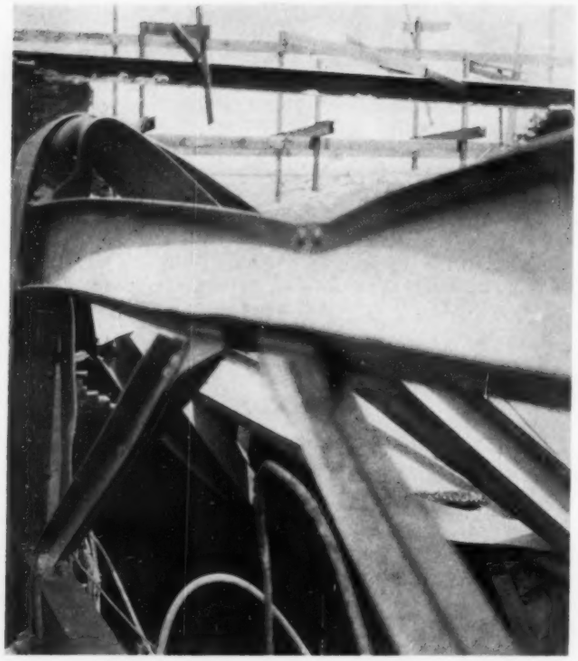
GROVER A. HUGHES

Copies of this Code are available at the Society's headquarters at 33 West 39th Street, New York City.

The following is the personnel of the Committee on Building Codes as constituted Sept. 30, 1934:

D. S. Jacobus, Pres.
American Welding Society

Moss, H. H., Chairman	Linde Air Products Co.
Male, Milton, Secy.	U. S. Steel Corp.
Anderson, J. L.	Air Reduction Co.
Balcom, H. G.	Consulting Engr.
Bissell, A. G.	Consulting Engr.
Bissell, C. T.	Consulting Engr.
Burton, Frank	Consulting Engr.
Doyle, E. A.	Linde Air Products Co.
Elder, F.	R. W. Hunt Co.
Ellis, A. R.	Pittsburgh Testing Lab.
Fish, G. D.	Consulting Engr.
Frankland, J. M.	Consulting Engr.
Hoar, W. S.	McClintic-Marshall Corp.
Hughes, G. A.	Truscon Steel Company
Lincoln, J. C.	Lincoln Electric Company
Llewellyn, F. T.	U. S. Steel Corp.
McKibben, F. P.	Consulting Engr.
Owens, J. W.	Fairbanks-Morse Co.
Priest, H. M.	Railroad Research Bureau
Vogel, Andrew	General Electric Co.
Vom Steeg, Jr. E.	General Electric Co.
Whittier, C. C.	R. W. Hunt Co.
Woofter, H. A.	Swift Electric Co.



(Fig. 1)—**Twisted steel framework in the wreckage of the Girls' High School, San Francisco, California**

The Sub-Committee on revision of the 1930 Edition was composed of the following Structural Engineers:

G. D. Fish	Consulting Engr.
G. O. Carter	Linde Air Products Co.
J. L. Edwards	H. G. Balcom
F. H. Frankland	Am. Inst. Steel Const.
S. H. Holtzman	Gunvald-Aus Co.
J. D. Marder	Marc Eidlitz & Son
N. A. Richards	Purdy & Henderson
Aubrey Weymouth	Post & McCord

February 1935 the American Welding Society formulated Code 2, Code for Resistance Welding of Structural Steel in Building Construction.

This code recognizes the use of resistance welding for the multiple shop fabrication of truss-shaped or beam shaped members for floors and roofs, and for shop fabrication of steel stringers and sheet metal parts of stairs and similar members.

The code covers materials, stresses, design, fabrication and testing, methods of qualifying of welding machines and operators. Copies of the code are available at the Society's Headquarters.

The Sub-Committee of the Code for Resistance Welding of Structural Steel in Building Construction was composed of the following Engineers:

W. A. Hoar	McClintic-Marshall Corp.
G. A. Hughes	Truscon Steel Co.
H. A. Woofter	Swift Electric Co.

The American Welding Society has assisted building commissioners and law makers in writing codes for buildings in various cities.

July 5, 1935, the Society reports 131 cities in the United States permit welding in their building codes.

REINFORCING BUILDINGS

Mr. A. F. Davis of the Lincoln Electric Company spent considerable time in California and reports arc welding of structural steel in building construction is recommended by the Authorities of that State.

In order to guard against earthquake destruction, the state of California has laws regulating the structural strength of buildings. Development of higher tensile strength steels, together with efficient processes for erecting them, have contributed greatly to preventing structural failures caused by tremors in the earth's crust.

Efforts in this direction have not stopped with erection of new buildings. Going further, additional strength has been given existing structures in order that they might resist earthquake shocks.

(Fig. 2)—**A rivet sheared off in the twisted wreckage of the San Francisco Girl's High School.**

A great deal of this work has been done on California school buildings. A total of 27 schools, 18 in the San Francisco Bay region and 11 in Southern California, have been strengthened. On all of these jobs, the shielded arc process of welding has been employed.

The welding of the steel framework of these schools required the highest quality of work. Tests were conducted by the National Re-employment Service to obtain most efficient welding operators. Tensile strength had to be 65,000 lbs. per sq. in. and ductility 20% elongation in 2 inches. The shielded arc process of electric welding was used to provide these physical properties. With this process, tensile strength is 65,000

to 85,000 lbs. per sq. in. and ductility 20 to 30% elongation in 2 inches.

The following school buildings have been strengthened by using the shielded arc process of arc welding:

School	Location
El Rodeo	Beverly Hills
Beverly Vista	Beverly Hills
Graham	San Pedro
Torrance High	Torrance
Anaheim Union High	Anaheim
Pomona High	Pomona
Woodrow Wilson High	Long Beach
Excelsior Union High	Norwalk
State School for Boys	Whittier
Fine Arts School	Inglewood
Public Schools	Santa Monica

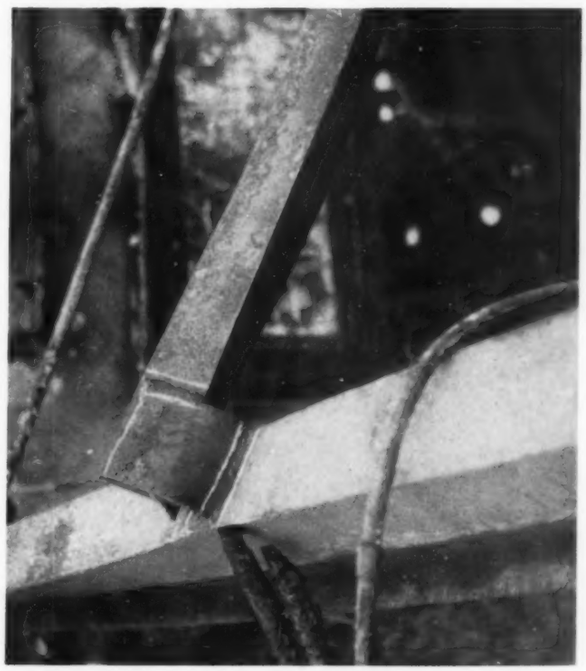
EDUCATION

Lehigh University several years ago saw the future of welding and added welding to their curriculum. Now several of the larger Universities have added welding to their curriculum, or are holding Welding Symposiums. Among the universities are Ohio State University, Purdue, Wisconsin, Texas Technological College, Case, Iowa and many others.

Welding schools have been conducted by the manufacturers of welding equipment, and many of our large fabricators, factories and mills.

With bare electrodes in 1919 our maximum tensile strength averaged 35,000 pounds per sq. in. Through education of our welding schools this strength has increased to 55,000 pounds per sq. in. maximum, using same kind of electrode.

(Fig. 3)—Terriffic forces which twisted the steel framework into all sorts of shapes did not loosen a single shielded arc weld.



NEW WELDING EQUIPMENT

The Lincoln Electric Company have brought out a new design of arc welders motor generator type for both D.C. Generators and A.C. Generators for welding. The new line of machines completely covers the range of welding current up to approximately 700 amperes single-operator type. The A.C. Generator operates at 240 cycles.

Mr. H. A. Winne of the General Electric Company reports their Company during the year 1934-35 developed and placed on the market a new line of single-operator arc-welding generators. The generators may be motor driven, gas-engine driven, or belt driven. The claims for these new generators are the high internal reactance, and the field structure and windings have been so designed that the transients are reduced to a minimum. It is claimed that this design gives excellent welding characteristics without the use of the usual external reactor in the welding circuit. The machines operate equally well with bare or heavily coated electrodes.

The arc-welding sets of this new line are somewhat lighter in weight and take up less space than the preceding machines. The control provides for ready adjustment of the welding current and voltage throughout the current range. The set is of drip-proof construction.

ALTERNATING CURRENT ARC WELDING

The General Electric Company has developed and built a complete line of transformers for supplying current for a-c. welding. The units are designed to give an open-circuit voltage of from 80 to 100, and a welding voltage of approximately 40.

With the A.C. equipment and with proper *heavily coated* electrodes, it is possible to produce welds which are in every way the equal of welds made with D.C. according to the claim of the manufacturer.

WELDING ELECTRODES

New heavily coated, or shielded-arc, types of electrode, represent very important arc-welding developments of 1934. Electrodes capable of producing welds of the quality required for Class I pressure vessels according to the ASME Boiler Code.

The distinctive feature is that it will produce Class I welds in any position, overhead, vertical, or flat. It therefore has a wide field of application in the fabrication of large structures, such as ships and locomotives, where it is impossible or impracticable to move the work into a special welding position—and in the welding of such fittings as nozzles and flanges to pressure vessels, where handling costs are less if positioning of the work is unnecessary.

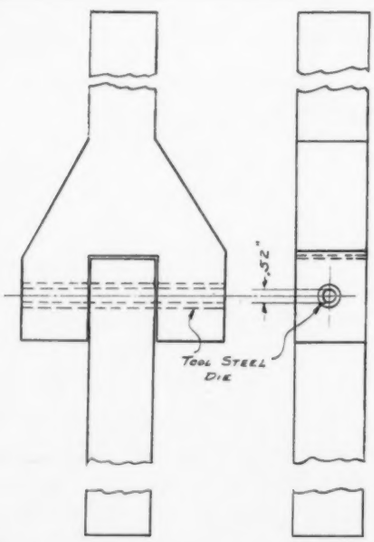
Following are average physical characteristic values for the new electrode as reported by the manufacturer:

	Type W-22		Type W-23	
	Welds not Stress Relieved	Welds Stress Relieved at 1200°F.	Welds not Stress Relieved	Stress Relieved at 1200°F.
Ult. Tensile—lb./sq. in.	70,490	61,730	69,000	65,800
Yield point— " "	56,600	45,180	62,200	54,460
Elongation—% in 2 in.	24.9	31.6	25	31.6
Specific gravity	7.829	.....	7.826	.....
Resistance to impact Charpy—ft. lb.	38.4	.....	33.0	.....

Free bend ductility values range from 40% to 60% and the resistance to corrosion is equal to, or better than, that of good quality-steel plate.

NEW ELECTRODE FOR HARDFACING AND CUTTING EDGES ON ALL KINDS OF TOOLS

A new arc welding electrode which is designed for restoring worn cutting edges on tools of all kinds and which is said to permit savings of 20 to 25 per cent in tool cost is announced by The Lincoln Electric Company, Cleveland, Ohio. By using this electrode, lathe tools, bits, milling cutters, drills, cutting and forming dies and all other tools which have become worn in service, according to the claim, can be given a new and harder cutting edge than has heretofore been possible. Tools can be refaced an unlimited number of times with this electrode.



(Fig. 4)—Tool for testing specimens in shear.

Also new tools using ordinary steel in place of high speed steels can be provided with a cutting edge at savings.

The electrode provides a deposit which is claimed to be equivalent to high speed tool steel, and has the advantage of retaining its hardness (55 to 65 Rockwell C) under relatively high temperatures, up to approximately 1000 degrees Fahrenheit.

Although the weld metal as deposited without heat treatment a hardness of 55 to 65 Rockwell C, the degree of hardness will vary somewhat depending upon the mixture of base metal with the weld deposit. In general, hardness is increased by permitting the deposit to cool slowly and by depositing additional beads.

This deposit can be heat treated in the same manner as high speed steel but at slightly less temperature.

RESISTANCE WELDING

The changes in resistance welding have been so many that space here will not permit the discussion in detail. However, the manufacturers of Resistance welding equipment report they are in position to make welders to meet the needs of the trade.

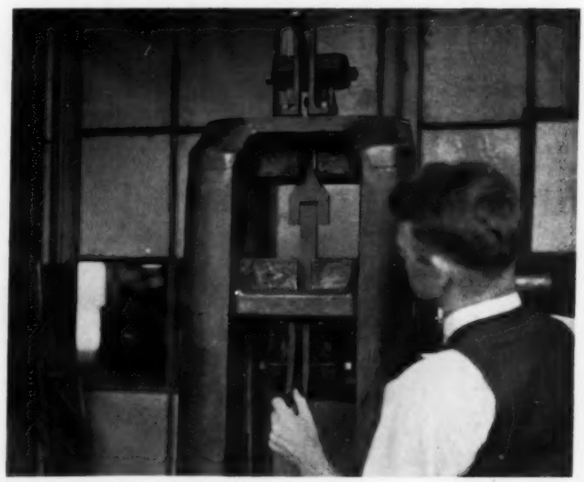
TIMERS FOR RESISTANCE WELDERS

As a supplement to the line of tube control equipment for spot and seam welders, there has been developed a synchronous timing control equipment for spot welders, designed especially for use where the timing requirements are not so rigid as to justify the installation of the more expensive tube control. It consists of a special Telechron motor and contactor mounted in a suitable case. The Telechron motor, through readily adjustable contacts, controls the contactor which may either directly control the primary of the resistance welder transformer, or may in turn control a larger contactor in the welder circuit. The timing is adjustable from 5 to 50 cycles. Still longer intervals can be obtained by the use of a lower speed motor.

There has been considerable information published on strength of metal deposited with the arc-welder but little information available concerning the strength of Resistance welds.

In order to obtain accurate data it was necessary to know the size of weld before testing. To make such a series of tests would require time and considerable outlay of money. Mr. Fred P. McBerty, President of The Federal Machine & Welder Company of Warren, Ohio was approached and agreed to do all the ma-

(Fig. 5)—Tool in testing machine.



(Fig. 6)—Type of flash welder used in making the butt welded specimens.

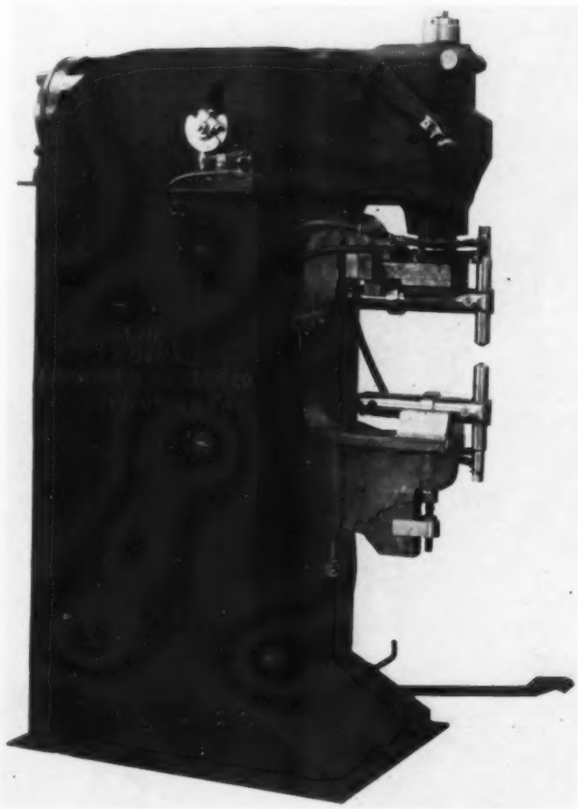
chine work of tools for testing, weld and machine the specimens.

It was decided to run two series of tests.

Series 1. On structural steel near the lower limit of 55,000 lbs. per sq. in. tensile with approximately .15 carbon.

Series 2. On structural steel near the upper limit of 65,000 lbs. per sq. in. tensile with about .30 carbon.

(Fig. 7)—Type of spot welder used in making spot welded specimens.



Each series we would test,

A. Parent metal—tensile—shear
B. Spot welds—shear.
C. Flash welds—tensile—shear.

Structural "grade bars 1¼" square were ordered for tensile tests of the steel bars, the specimens were turned to one inch dia.

The shearing test specimens were turned to ½" diameter and tested two at a time. Fig. 4 shows tool for testing specimens in shear. Fig. 5 shows the tool in testing machine. Utmost care being taken to keep the tool vertical to insure equal loading on the specimens in the tool.

The spot welded and butt welded specimens were turned to ½" dia. then etched so the weld could be accurately located in the testing tool. Fig. 6 shows the type of flash welder used in making the butt welded specimens. Fig. 7 shows type of spot welder used in making spot welded specimens.

Both machines are full automatic. This insured us uniformity in welding since the variables entering into resistance welding, (time, current, pressure) were constant and beyond control of the operator.

The maximum tensile of the bars was considerably higher than we ordered. However, we decided to continue with the tests as planned.

Table 1 gives results of tests of Series 1.

Table 2 gives results of tests of Series 2.

(All testing speeds ⅛" per min.)

Table 1		Series 1			
Car. 16	Mang. 51	Phos. .016	Sul. .035		
Test Speci.	Stress	No. of Tests	Pounds per Sq. In.		
			High	Low	Aver.
Parent.....	Tensile	5	61880	61200	61740
"	Shear	5	50170	48700	49350
Flash Weld....	Shear	10	49890	47630	48580
"	Tensile	10	61010	57090	59120
Spot "	Shear	10	48980	47080	47810

Table 2		Series 2			
Car. 33	Mang. 35	Phos. .007	Sul. .04		
Test Speci.	Stress	No. of Tests	Pounds per Sq. In.		
			High	Low	Aver.
Parent.....	Tensile	5	69700	68430	69270
"	Shear	5	55930	54760	55240
Flash Weld....	Shear	10	55600	53480	54900
" "	Tensile	10	69380	67450	68810
Spot "	Shear	10	54110	50330	52310

The information contained in table 1 and 2 offers material for much thought and careful study. We give it as it is. It speaks for itself.

Later, at Mr. McBerty's suggestion we continued our research of resistance welding on various grades of steel from .15 carbon to .80 in equal steps of .05. The results are too long to give at this time.

The Pouring of Molten Steel

By J. P. WALTERS, Open Hearth Superintendent
and Dr. E. G. HILL, Director of Research
LUKENS STEEL COMPANY

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ RECENTLY PUBLISHED STATISTICS show that the general trend of the "yield" from steel ingots has been downward. This is attributed to more stringent specifications and more critical inspection of finished steel. As the yield is the percentage of the original ingot weight found in the form of finished steel, it is obvious that steel makers are making every effort to produce ingots which will raise the yield. Ladle design and set-up, ingot design and preparation, pouring rates and temperatures, and methods of teeming all have been studied intensively.

In order to handle the large mass of metal tapped from modern furnaces, the oval ladle has been adopted. This gives a greater settling area and reduces ferrostatic head. Refractories have not been changed to any great extent, but new shapes have given lower costs and longer life. Monolithic linings and coatings have been tried and a few operators have experimented with basic linings. Stopper rod assembly has been standardized in plants in order to eliminate the personal factor. Harder burned nozzles are used by those who regulate the teeming stream by partial shut off, and composite nozzles have been tried.

In both top and bottom pouring practices much effort and ingenuity have been spent in preventing splash. Some of the devices used are basins in bottom plates, with or without refractory linings, stove pipes suspended in the molds, wooden boards placed over outlets, careful opening up of the nozzle, and special shaped nozzles.

The rate of rise of metal in the molds is controlled by basket pouring, the use of double nozzles, varying nozzle size to suit the mold, and regulating the number of molds per bottom plate. Most operators control pouring temperatures by taking temperatures with the optical pyrometer and then holding in the ladle until the proper temperature drop has taken place. The Fitterer thermocouple offers a new method of obtaining temperature of the metal. Much work has been done in determining the best pouring temperature for each type of steel.

The importance of mold design is recognized. The elimination of cracks in ingots is still a difficult problem.

J. P. WALTERS

DR. E. G. HILL

Corner radius, contour of the inner cross-section, ratio of ingot cross section to mold wall cross section, are some of the vital factors. The big end up ingot molds are used extensively for quality steels and their use has been advocated for rimming steels.

Many advantages are claimed for the use of copper stools. Increased life and better ingot structures have resulted from their use in some plants. To eliminate the cutting of stools, plugs, plates, and basins are in use. Some operators have used sectional bottom plates held in steel frames.

For better ingot surfaces and prolonged mold life, a great variety of mold washes are applied, such as, tar, graphite, talc, asphalt lacquer, carbon black, lime, and aluminum paint. All agreed on the use of clean warm molds.

Special hot tops, both patented and home made are being changed to get cheaper set ups and better feeding. New materials are on the market for covering the hot top metal, for which are claimed better insulation and even heat generation.

These are some of the weapons the production man is using in his constant fight to produce ingots which will roll into steel free from scabs, snakes, pits, slivers, laminations, and blisters. As these go down his yield goes up and conversely the pressure from above goes down.

Manufacture of Iron and Steel Rolls

By S. H. GRIFFITHS and J. L. CAMPBELL
Ohio Steel Foundry Company
LIMA, OHIO

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ ROLLS PLAY a very important part in the operation of a mill. Roll foundries have made rapid strides in the past twenty years in developing rolls that are in use at the present time. It was absolutely necessary that this be done in order to keep pace with the advancement in rolling mill practice and the design of the modern mills.

It cannot be disputed that with the limitations of the rolls manufactured twenty years ago the present modern strip mills would not have been possible. In fact the vast majority of sheet and tin mill operators of that era were resigned to the fact that there could be little improvement on the old hand-operated hot mills. The idea of a single sheet of steel going through a continuous series of stands and being reduced to the gauges obtained in the present strip mills, without reheating, was at that time but a fantastic dream. A suggestion that water be used on these rolls, which would further reduce the temperature of this sheet, would have been considered absurd. Furthermore, had this fantastic dream been coupled with this absurd suggestion, and a continuous strip mill constructed, the rolls available at that time would not have been able to resist "tail marking".

The roll foundries cannot claim all the credit for the advancement made in developing the present type of rolls. Improvement in foundry practice, heat treating, and the metallurgical phases can be attributed directly to the foundries. However, the part played by the roll designers, engineers and mill operators, the men who live with the rolls day in and day out, is a very important one. It is from these men that the roll makers obtain the problems to be encountered and also the information as to the performance of various types of rolls in actual service. The value of this cooperation between the rolling mills and the roll foundries cannot be over-estimated. It is not practical to experiment with rolls under typical working conditions on a laboratory scale as is done by paint manufacturers for example. A gallon of paint suffices for this research. They don't need a carload. With rolls, the design of the mill and rolls, the material rolled, the finish required, the speed of the mill, the temperature of the material, and the amount of water used, are all factors that have to be considered. The proper finish, tonnage rolled and roll cost per ton depend upon the proper application of rolls.

This does not mean, however, that no research is done in the laboratories of the various roll manufacturers. There is a continual compilation of chemical and metallurgical data day by day. Practically every foundry keeps a card index record of each and every roll. Any report from the mill regarding the performance of a roll is written on the card which already contains the chemical analysis, the heat treatment, and the foundry practice. Also any unusual mill conditions are noted.

Various types of rolls are sawed through the bodies and necks. The flat internal surfaces are machined, polished and then macro-etched. In this way the foundry practice is checked to ascertain whether proper feeding has been afforded, also whether the surface condensation of grain is of sufficient depth to meet the requirements demanded of that particular roll in service.

Photo-micrographs are used quite extensively to compare grain structures of both iron and steel rolls and prove to be a great help in working out the proper heat treatment to be given each type. A series of these pictures provides the metallurgist with a check on each stage of his heat treating cycle, enabling him to alter his practice in the proper place.

J. L. CAMPBELL

Physical testing of iron and steel rolls is somewhat limited. The usual standard of physical properties such as ultimate tensile strength, yield point, reduction of area, elongation, and impact values cannot be satisfactorily determined because of the comparative brittleness of the material. Hardness values are taken however, usually in terms of Shore scleroscope readings. Relative strength of roll mixes are compared with data obtained from transverse tests of the material. Standard transverse test bars are cast from regular roll heats. The American standard iron arbitration test bar is 1.2″ in diameter and 21″ long. The bar is supported on knife edges spaced 18″ apart. A load is steadily applied from above, at a point equidistant between the supports, until the bar fails. The maximum load withstood and the amount of deflection are recorded. The results obtained from transverse tests are very valuable when experimenting with analyses and heat treatments with the development of stronger rolls in view.

Rolls are primarily classified into two general types—iron base and steel base. To be metallurgically correct, the dividing line between iron base and steel base rolls is at the maximum carbon solubility point of the metal under normal cooling conditions. This point is normally approximately 1.70% carbon subject to change when alloys are present. This line is not so clearly defined by the roll industry. Steel base rolls frequently have up to 2.60% carbon content and in some instances are called steel base with 3.00% carbon. This over-lapping of classifications is justified by the fact that in most instances it occurs by extending steel base grades in accordance with increasing carbon contents and makes the price schedule less complicated.

Iron base rolls are either sand cast or chill cast. Sand cast rolls, as the name implies, are cast in sand moulds. Chill cast rolls have their bodies cast in grey iron cylinders having a wall thickness of 4 to 7 inches. Chill cast rolls in turn have two classifications; namely, clear chill and condensed grain.

In the former the analysis is so adjusted that the cooling effect of the cast iron chill produces a definite crystalline shell to a predetermined depth. The carbon content of this band is 100% in the combined state. The center core of the bodies, also the necks and wabblers, are grey iron as the carbon in excess of the solubility or saturation point is in the graphitic state. The hardness of this type of roll is controlled within limits by raising or lowering the carbon content. The introduction of alloys also plays an important part in producing varying degrees of hardness, toughness, and strength in this type of roll. Accuracy in obtaining the required depth of chill depends upon the ability of the furnace operator to transpose the reading of the chill test taken from the furnace, to the depth of chill which rolls of a certain diameter will contain, and to adjust the analysis of his melted heat accordingly.

The condensed grain type is an alloy iron roll poured in the same kind of iron chill but differs from the clear chill type in that no shell of 100% combined carbon is present. The analysis is so adjusted that graphitic carbon appears all the way to the surface of the body as very minute particles and evenly scattered. The size of these graphitic particles increases as the center axis of the roll is approached and the chilling effect of the iron mould is less severe. The grain of the roll therefore becomes more open toward the center, a gradual tapering off of density from the surface of the body.

Plates, skelp, strip, sheets, and tin plate receive most of their reduction on chill cast iron base rolls in the hot mills. The flat rolling of steel is of paramount interest to this group at this meeting, particularly the operations of the modern strip mills. On the cold mills chill cast and hardened forged steel rolls are used. Since this paper is not a discussion on the relative

S. H. GRIFFITHS

merits of cast and forged steel rolls, we will say that each type shows to advantage depending upon existing conditions. Chill cast rolls have been developed with a surface hardness of 90 to 95 scleroscope and hardened forged steel rolls 100 to 110 scleroscope.

Hot strip mills use chill cast iron base working rolls for the most part. Where the design of the mill is such that deflection of the rolls and reductions for each stand are not excessive, the clear chill alloy iron rolls are used throughout. Other mills are known to use the condensed grain type throughout when greater strength is required, while still others employ the use of both. The amount of deflection of the working rolls is apparent to the roll makers by the amount of crowning asked by the operators and has to be taken into consideration. Tail marking, spalling, and roll breakage by various causes, are very costly troubles as they interfere with production schedules and temporarily halt the operation of a mill that represents quite an outlay of capital. The mill operators naturally are constantly striving to eliminate forced shut-downs by correcting any faulty practice they notice. At the same time the roll foundries are not only notified when their rolls are at fault but are also asked to co-operate when it is not feasible to change bad mill conditions which are known to exist at the time.

Steel base rolls come into use in the flat rolling of steel in blooming, slabbing and bar mills. They are also used as backing-up rolls in four-high strip mills. The manipulation and use of alloys along with improvement in foundry and heat treating practices have resulted in better steel base rolls.

Does the average layman who looks at a large roll (some as large as 56 inches in diameter and weighing 91,000 pounds), and notices that the entire surface is free from defects and that the ends are perfectly sound, realize that more is involved than merely pouring the steel in a mould as is done in the case of an ingot– The rectangular shape of the ingot, also generally corrugated, gives it much more cooling surface than the same mass of steel in the cylindrical roll. Then, too, the ingot does not have a neck through which the sinkhead has to feed molten metal to the body, as in the case of the roll. The addition of excess stock to the cope or top neck and the use of metal chills around the body to accelerate the rate of cooling of the larger mass, take care of this problem. To insure a flawless surface the rolls are poured through a gate that enters the mould in the drag or bottom neck at a tangent. The metal entering the cylindrical mould at a tangent sets up a swirl, the centrifugal action of which sends any particles of dirt to the center of the vortex—thence rising with the steel up into the sinkhead. Such factors as pouring temperature, shakeout temperature, and diameter and height of sinkheads, are standardized and closely adhered to under the supervision of foundrymen with years of roll-making experience behind them.

A backing-up roll that will give greater wear and more resistance to spalling is one of the problems confronting the foundries at the present time. Blooming mill rolls are being developed that will give greater wear and at the same time be resistant to slippage and fire cracking. The old practice of "ragging" blooming and slabbing rolls is going into discard because evidence of its use appears on the finished product. Special hardened steel base rolls are at present in the stage of development and experimentation.

New and better rolls will continue to appear on the market—the roll foundry's answer to the rolling mill's demand for greater production and the steel consumer's request for a better product both in finish and closer tolerances. To survive in a highly competitive field the foundries are aware that they must not stand still. The old adage applies perfectly "The man who says a thing can't be done usually wakes up to find somebody else doing it."

The Venturi Port

By GEORGE L. DANFORTH, Jr., President
Open Hearth Combustion Company
CHICAGO, ILLINOIS

Abstract of paper to be presented before the A. I. & S. E. E. Convention, Pittsburgh, Sept. 24, 25, 26, 1935.

▲ THE AUTHOR has had the privilege of being closely associated with a number of major improvements accomplished in the past twenty-five years in connection with the construction and operation of open hearth furnaces. These improvements include waste heat boilers, more efficient regenerators, the Naismith sloping back wall, the damper controlled port, and the venturi port.

The purpose of this paper is to describe the design, construction and operation of the venturi port and the results accomplished therewith in comparison with the orthodox ports previously used and with the damper controlled ports which were conceived and to a considerable extent developed at approximately the same time the venturi port was being put into successful use.

It has long been realized by the open hearth fraternity that the port is a very important, possibly the most important part of the open hearth furnace, for on it depends the introduction of the fuel and air, the character and control of the flame developed in the melting chamber, and the exhaust of the products of combustion. It has likewise been recognized that a port construction best designed for introducing and mixing the fuel and air is not the best for meeting the outgoing conditions, including the destructiveness of the outgoing gases, sometimes at excessive temperature, and laden with dust and fumes highly detrimental to the brick work of the outgoing port.

The function desired of the incoming port is to introduce the air and fuel in such a manner that the two are quickly mixed to produce rapid combustion with a short, hot flame controlled to concentrate on the materials to be melted and refined, and kept as far as possible from the adjacent brick work. This suggests a port having passageways of relatively small area to give high velocity and direction to the incoming fuel

GEORGE L. DANFORTH, Jr.

and air, but the requirement of the outgoing port is to provide an exit for the exhaust gases with a minimum resistance to their flow and with a minimum destruction of the port, and this suggests a port of large area, through which the waste gases may exhaust with low velocity. It is therefore no wonder that a number of differently designed ports have been used in the endeavor to effect the most satisfactory compromise between the incoming and outgoing conditions.

It is obvious that not all of the different port designs previously used can be shown and discussed. The drawings accompanying this paper show typical ports of previous design, one for producer gas, one for natural gas, and one for liquid fuel, in comparison with the venturi port designs used for the several fuels mentioned.

It will be noted that the port typical of previous designs for producer gas has the monkey walls located in the air port entirely above the gas port, with their apexes in line with the mouth of the gas port and considerably removed from the junction of the port slope with the furnace roof. This restriction in the air port is intended to increase the velocity of the air, in order to drive it into mixture with the fuel in the combustion and melting chamber, for there is no mixing chamber provided between the gas and air ports and the melting chamber, and the vertical area at this point is considerably greater than that of the gas and air ports, and that of the gas and air uptakes. With this general arrangement, the mixture of fuel and air is made entirely in the melting chamber, is not as rapid as desired, and results in a long flame deficient in temperature on the incoming end of the furnace hearth and excessively hot adjacent the outgoing port. Furthermore, the restriction in the air port is not far distant from the end wall of the port, and the resulting high velocity of the hot waste gases through the outgoing port, coupled with the small downtakes extending from the port to the slag pocket, is excessively damaging to the adjacent brick work, as well as to the furnace draft.

In recognition of the difference in the requirement of the incoming port compared with that of the outgoing port, the damper controlled port was devised to restrict the area when functioning as the incoming port and to open up this area when functioning on the outgoing end of the furnace. This was accomplished by inserting restricting water-cooled brick lined dampers into the incoming port, and withdrawing them from the outgoing port. This required a considerable amount of equipment, which in addition to the first cost for installation, imposed a constant expense for maintenance and the heat losses due to the use of the unusual amount of cooling water. These disadvantages largely offset the advantages gained.

The object of the venturi port invention, Patent No. 1,647,213, was to provide a port which when functioning as the incoming port, would mix the air and fuel as rapidly as desired, and produce a shorter, hotter, and better directed flame, which would accomplish its melting and refining work before reaching the outgoing end of the melting chamber, with consequently less damage to the outgoing port and end wall, with no impairment to the furnace draft, and without the disadvantages of water-cooled dampers. This has been accomplished with a port construction comprising short fuel and air passageways, each having a relatively large area adjacent its end wall, gradually decreasing in area and merging into a common passageway or mixing chamber having a throat of relatively small area connecting with the end of the melting chamber, which is likewise contracted and then gradually expanded to its normal area.

The port arrangement described provides a venturi-like section, extending from the end wall of the furnace to well within the melting chamber, which permits the use of the smaller port desired for incoming purposes without retarding the passage of the waste gases through the outgoing port. To further assist the exhaust of the waste gases, and to minimize their damaging effect on the adjacent brick work, the downtakes from the port to the slag pocket are made considerably larger in area than was customary with previous designs.

It may be noted that the venturi port, when designed for the use of natural gas, provides a smaller throat for introducing the air and gas, and a wider downtake for exhausting the waste gases than were permissible in the previous construction for such fuel. Inasmuch as the development and direction of the natural gas flame are very dependent on a high velocity flow of the air, the smaller throat is of material assistance in this respect, and the larger downtake not only assists in making the smaller port permissible, but also reduces the velocity of the outgoing gases at this point and minimizes the damage to the adjacent end wall.

A very large number of open hearth furnaces are now equipped with the venturi port, with a notable increase in production and decrease in the expense for labor, fuel and furnace maintenance. It is also recognized that even with a cheaper grade of materials in the furnace charge, the furnace construction affording the best combustion control will produce the better quality of steel.

Tabulation of Applications of Anti-Friction Bearings to Roll Necks of Steel Rolling Mills in Service

The Association of Iron and Steel Electrical Engineers again presents herewith a tabulated list of anti-friction Bearings applied to Roll Necks in the iron and steel industry.

This list was prepared at the National Offices of the A. I. & S. E. E. under the direction of the special committee on bearings and is submitted to the iron and steel industry with the purpose of indicating only the progress being made in the application of anti-friction bearings to roll necks.

The engineering data and information furnished in this list, has been secured from so many sources that it may require corrections and additions from time to time. The list does not represent the complete installations in the industry, however over 90% of the steel mill ingot tonnage capacity is accounted for.

The Association will welcome constructive suggestions on additions and corrections.

HOT SHEET, STRIP, PLATE AND SKELP MILLS

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
Hot Strip	4-High	4	18″	37″	38″	Allegheny Steel Co., Brackenridge, Pa.	Backing Rolls Work Rolls	525185-525321 275106-275160-61	Timken	1932
Hot Strip	4-High	3 1 2 2	16″	38″	48″	American Rolling Mill Co., Butler, Pa.	Backing Rolls Backing Rolls Work Rolls Work Rolls	480181-480340 EE-275109-275155 	Timken Messinger Timken Messinger	1929-32-33 1929 1934 1929
Hot Strip	4-High	3 4 1 1 5	18″ 18″ 18″ 18″ 18″	40″ 40″ 40″ 40″ 40″	72″ 58″ 58″ 58″ 58″	American Rolling Mill Co., Middletown, Ohio	Backing Rolls Backing Rolls Backing Rolls Backing Rolls Work Rolls	 327221-327355-56 A-690-C A-926-C A-467-B	Messinger Timken Bantam Bantam Bantam	1928 1929 1934 1935 1933
Hot Strip	4-High	6 1½ 6 2	16″ 16″ 16″ 16″	34″ 34″ 34″ 34″	41″ 41″ 41″ 41″	American Sheet and Tin Plate Company, Gary, Indiana	Backing Rolls Backing Rolls Work Rolls Driven End Opposite End Work Rolls Float End Work Rolls Thrust End	425178-79 425298-99 A-448-D 89108-89150-51 EE-126096-126150 A-1031-B A-1032-A	Timken Bantam Timken Bantam Bantam	1930-31 1933 1932-33 1935 1935
Hot Strip	2-High	1	36″		80″		Roll Necks	A-1114-B	Bantam	1935
Hot Strip	4-High	1	40″	54″	130″		Work Rolls	U-540-B	Bantam	1935
Hot Strip	4-High	8	26″	53″	80″		Backing Rolls Work Rolls	A-1034-D A-1033-B	Bantam Bantam	1935 1935
Hot Strip	4-High	9	25″	49″	79″	Bethlehem Steel Co., Lackawanna, N. Y.	Work Rolls	EE-234157-234215-6	Timken	1935
Hot Strip	4-High	7	21″	45″	43″	Carnegie Steel Co., Youngstown, Ohio	Backing Rolls Work Rolls	EE-715212-715380 EE-133136-133180-1	Timken Timken	1935 1935
Hot Strip	4-High	1	21″	45″	43″		Backing Rolls Work Rolls	C-875-C U-421-B	Bantam Bantam	1935 1935
Hot Strip	4-High	7 1	21″ 21″	46″ 46″	56″ 56″	Ford Motor Company, Detroit, Michigan	Backing Rolls Work Rolls Edger	EE-424257-424405-6 EE-133136-133180-1 I-55-B	Timken Timken Bantam	1934 1934 1934
Hot Strip	4-High	6	18″	37″	38″	Great Lakes Steel Corp., Ecorse, Michigan	Backing Rolls Work Rolls	525182-525320 275106-275160-61	Timken Timken	1930 1930
Hot Strip	4-High	9	25″	49″	79″		Work Rolls	EE-239171-239225-6	Timken	1935
Hot Strip	4-High	6	18″	43″	38″	Illinois Steel Co., Gary, Indiana	Backing Rolls Work Rolls	I-265-C C-661-B	Bantam Bantam	1935 1935
Plate Strip	4-High	6 1 1	24″ 24″ 24″	52″ 52″ 52″	96″ 96″ 96″	Illinois Steel Co., South Chicago, Illinois.	Backing Rolls Work Rolls Edger Edger	690296-690465-66 I-46-C I-52-B	Timken Messinger Bantam Bantam	1931 1931 1931 1931
Hot Strip	4-High 4-High	1 9	36″ 25″	49″ 49″	96″ 76″	Inland Steel Company, Indiana Harbor, Indiana.	Backing Rolls Backing Rolls Backing Rolls Work Rolls	628285-628465 627260-627435 427261-427435-6 234157-234215-16	Timken Timken Timken Timken	1932 1932 1935 1932
Hot Strip	4-High	2	11″	22″	22¾″	Laclede Steel Company, Alton, Illinois	Backing Rolls Backing Rolls	551000-551700-01 CS-31077-CS-31031	Timken Rollway	1927 1928
Hot Strip	2-High	1	21½″			McLouth Steel Corp., Detroit, Michigan	Roll Necks Roll Necks Thrust End	6481 6482	 Messinger	 1934
Continuous Skelp Mill	4-High		13″	26″	20″	National Tube Company, McKeesport, Pa.	Backing Rolls	1-26315	SKF	1928
Hot Strip	4-High	5	20″	45″	72″	Otis Steel Company, Cleveland, Ohio.	Backing Rolls Work Rolls Thrust End	527236-37-527380-81 129121-129172-73	Timken Timken	1932 1932

HOT SHEET, STRIP, PLATE AND SKELP MILLS—(Continued)

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
Hot Strip	4-High	5	20″	45″	72″	Otis Steel Company Cleveland, Ohio.	Work Rolls Opposite End		Messinger	1932
Hot Strip	4-High	5	16″	32″	42″	Republic Steel Corp., Warren, Ohio.	Backing Rolls	R-179-E	Bantam	1930
							Work Rolls	R-144-G	Bantam	1930
		1	16″	32″	42″		Edger	I-55-B	Bantam	1935
		1	16″	32″	42″		Edger	R-285-A	Bantam	1935
Hot Strip	4-High	4	15″	32″	24″	Sharon Steel Hoop Co., Sharon, Pa.	Backing Rolls	726181-726287	Timken	1932
							Work Rolls	9975-9920	Timken	1932
Hot Strip	3-High	1	7″	12″ Baby Roll	14″	Stanley Works, Bridgeport, Conn.	Baby Roll	74537-74850	Timken	1932
Hot Strip	2-High	2	10½″		18″	Washburn Wire Company, Phillipsdale, R. I.	Caster Rolls on Work Roll Necks	840762-842200	Timken	1929
							Vertical Rolls Upper and Lower	(2) 95500-95295	Timken	1934
Hot Sheet	4-High	1	18″	30″	32″	Wheeling Steel Corp., Steubenville, Ohio.	Work Rolls	W-433-A	Bantam	1935
Hot Strip	4-High	3	21″	44″	60″		Backing Rolls	662301-663550-51	Timken	1928
							Work Rolls	231401-232025	Timken	1928
		6	18″	44″	60″		Backing Rolls	662301-663550-51	Timken	1928
							Work Rolls	EE-129121-129172	Timken	1934-35
							Work Rolls	111201-111700	Timken	1928
Hot Strip	4-High	1	22½″	44″	72″	Youngstown Sheet & Tube Co., Indiana Harbor, Indiana	Work Rolls	EE-161403-161900-1	Timken	1934
							Backing Rolls	2467-2		
							Backing Rolls Thrust End	2468-1	Messinger	1926
Hot Sheet	3-High	1	20″	32″	48″	Youngstown Sheet & Tube Co., Youngstown, Ohio.	Middle Roll	EE-291203-291750	Timken	1933
		8	24″	49″	79″		Work Rolls		Messinger	1934
Hot Strip	4-High	1	24″	49″	79″		Work Rolls	EE-234157-234215-16	Timken	1934

COLD STRIP, SHEET AND TIN PLATE MILLS

Cold Strip	4-High	1	5½″	19″	18″	Acme Steel Company, Riverdale, Illinois.	Backing Rolls	551000-551700-01	Timken	1930
							Work Rolls		Rollway	1928
Cold Strip	2-High		12½″		16″		Roll Necks	A-1137-A	Bantam	1934
Cold Strip	4-High		8½″	25″	22″		Work Rolls Thrust End	A-792-A	Bantam	1934
							Backing Rolls	A-1138-B	Bantam	1935
Cold Strip	4-High	4	12″	30″	50″	Allegheny Steel Co., Brackenridge, Pa.	Backing Rolls	551700-572650-51	Timken	1927
*Cold Strip	4-High	1	2¼″	20″	7½″	Allegheny Steel Company, West Leechburg, Pa.	Backing Rolls	2887-2	Messinger	1928
*Cold Strip	4-High	1	2¼″	20″	7½″		Backing Rolls	4146	Messinger	1930
*Cold Strip	4-High	1	2¼″	20″	7½″		Backing Rolls	4146	Messinger	1930
*Cold Strip	4-High	1	3″	24″	20″		Backing Rolls	3592-2	Messinger	1930
*Cold Strip	4-High	1	4″	26″	26″		Backing Rolls	4166-2	Messinger	1931
Cold Strip	4-High	1	14″	34″	58″	American Rolling Mill Company, Ashland, Kentucky.	Backing Rolls	671799-672873-74	Timken	1929
							Top	EE-423179-87-423300-1	Timken	1935
		5	14″	34″	58″		Backing Rolls Bottom	425176-7 425298-9	Timken	1931-33-34
Cold Strip	4-High		14″	34″	58″		Backing Rolls Top	R-212-E	Bantam	1935
							Bottom Backing Rolls	A-448-D	Bantam	1935
Cold Strip	4-High	7	14″	32″	42″	American Rolling Mill Company, Butler Pa.	Backing Rolls	571700-572650-51	Timken	1926
							Backing Rolls	EE-924172-924289	Timken	1933-34
							Work Rolls	CS-31064	Rollway	1928
Cold Sheet	2-High	1	26″		58″	American Sheet & Tin Plate Company, Gary, Indiana.	Roll Necks	911601-912400-01	Timken	1929
Cold Sheet	2-High	1	24″		44″		Roll Necks	B-1204-C	Bantam	1933
Cold Sheet	2-High	3	28″		84″		Roll Necks	B-1236-E	Bantam	1934
Cold Strip	4-High	1	16″	46″	42″		Backing Rolls	629256-629405-06	Timken	1931
							Backing Rolls	EE-424257-424405-06	Timken	1934
							Work Rolls 2 per position	93801-93125	Timken	1931
Planishing	4-High	1	13″	27″	42″		Backing Rolls	EE-321146-321245	Timken	1933
							Work Rolls	94704-94113	Timken	1933
Cold Mill	4-High	1	20½″	56″	84″		Backing Rolls	EE-727302-727511	Timken	1934
							Backing Rolls	EE-433301-433512-13	Timken	1935
							Work Rolls	EE-129121-129172-73	Timken	1934
Cold Mill	4-High	1	20½″	56″	84″		Backing Rolls	A-412-C	Bantam	1933
							Backing Rolls	A-973-B	Bantam	1935
							Work Rolls	A-417-B	Bantam	1933

*Rolls, Frictionally Driven

COLD STRIP, SHEET AND TIN PLATE MILLS—(Continued)

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
Cold Tin Plate	4-High	1	16″	49″	42″		Backing Rolls	EE-428262-428420-21	Timken	1933
							Backing Rolls	U-265-D	Bantam	1933
							Work Rolls 2 per position	93801-93125	Timken	1933
Cold Strip	Cluster	1	7¼″	14½″	18″		Backing Rolls	B-1412-B	Bantam	1934
Cold Strip	4-High	1	16½″	32″	84″		Backing Rolls	B-1236-E	Bantam	1934
						American Sheet & Tin Plate Company, Gary, Indiana.	Work Rolls	A-773-C	Bantam	1934
			20½″	32″	84″		Work Rolls	A-417-B	Bantam	1933
							Backing Rolls	EE-243193-243250-51	Timken	1935
Cold Strip	4-High	2	20″	48″	84″		Backing Rolls	A-1077-D	Bantam	1935
							Work Rolls	B-1472-B	Bantam	1935
Cold Strip	4-High	1	20″	36″	42″		Backing Rolls	A-448-D	Bantam	1935
							Work Rolls	B-1472-B	Bantam	1935
Cold Strip	4-High	1	12″	49″	42″		Work Rolls	A-932-J	Bantam	1935
Cold Sheet	4-High	1	16″	48″	84″	American Sheet & Tin Plate Company, Farrell, Pa.	Backing Rolls	532296-532245-45	Timken	1930
Cold Sheet	4-High	1	16″	34″	55″	American Sheet & Tin Plate Company, McKeesport, Pa.	Backing Rolls	CS-31042	Rollway	1928
							Backing Rolls	A-541-D	Bantam	1934
							Work Rolls	CS-31041	Rollway	1928
Cold Strip	Cluster Tandem	4	10½″	21½″	32″		Backing Rolls	941200-941950-51	Timken	1927
Cold Strip	4-High Tandem	4	11½″	25″	16″		Backing Rolls	790117-790220	Timken	1931
							Work Rolls 2 per position	82576-82950	Timken	1931
Cold Strip	4-High Tandem	4	13½″	33″	26″		Backing Rolls	123167-123290	Timken	1931
							Work Rolls 2 per position	94700-94113	Timken	1931
Cold Mill	2-High		8⅜″		8″		Roll Necks	I-70176-6221	SKF	
Cold Mill	2-High		10⅝″		10¼″		Roll Necks	I-70177-6228-x	SKF	
Cold Mill	2-High		10⅝″		18″	American Steel & Wire Company, Cleveland, Ohio.	Roll Necks	I-70177-6228-x	SKF	
Cold Mill	2-High		10⅝″		18½″		Roll Necks	7813-6228x376	SKF	
Cold Mill	2-High		13″		24″		Roll Necks	I-70192-6234-x	SKF	
Cold Mill	2-High		16½″		24″		Roll Necks	I-70191-I-70193	SKF	
Cold Strip	2-High		8″		8″		Roll Necks	A-312-C	Bantam	1932
Cold Strip	2-High		10″		10″		Roll Necks	A-313-C	Bantam	1932
Cold Strip	2-High		16″		24″		Roll Necks	A-314-E	Bantam	1932
Cold Strip	2-High	1	18″		32″		Roll Necks 2 per position	(2) 251000-251575	Timken	1927
							Roll Necks 2 per position	A-622-C	Bantam	1934
*Cold Strip	4-High	1	2¼″	20″	7½″		Backing Rolls	4146	Messinger	1930
*Cold Strip	4-High	1	2¼″	20″	7½″	American Steel & Wire Company, Worcester, Mass.	Backing Rolls	4146	Messinger	1930
Cold Mills	2-High	21	8″		8″		Roll Necks	(2) 71450-71750	Timken	1933-34
Cold Mill	Special		14½″		10″	Athenia Steel Company Clifton, N. J.	Roll Necks	22332	SKF	
Cold Mill	Special		6¾″		4¾″		Roll Necks	22315	SKF	
*Cold Strip	4-High	1	3″	24″	18″	Bethlehem Steel Company, Sparrows Point, Md.	Backing Rolls	MF-5319	Rollway	1929
Cold Strip	Cluster	1	7″	14″	24″	E. W. Bliss Company, Salem, Ohio.	Backing Rolls	210750-211300-01	Timken	1929
Cold Strip	2-High	1	8″		12″	Bopp Steel Corporation, Detroit, Michigan.	Top Roll	B-1265-B	Bantam	1934
Wire Flattening Mill	2-High	1				Chicago Steel & Wire Co., South Chicago, Illinois.	Roll Necks	366-362-A	Timken	1934
*Cold Strip	4-High	1	2¼″	20″	7½″	Crucible Steel Company, Jersey City, N. J.	Backing Rolls	MF-5319	Rollway	1929
*Cold Strip	4-High	1	2¼″	20″	7½″		Backing Rolls	MF-5319	Rollway	1929
*Cold Strip	4-High	1	3½″	19″	7½″		Backing Rolls	6510	Messinger	1934
Cold Mill	4-High	1	10″	26″	24″	Detroit Steel Company, Detroit, Michigan.	Backing Rolls	EE-971355-972100-3	Timken	1935
							Work Rolls	74510-74850	Timken	1935
Cold Strip	3-High	1	3¼″	9″	9$\frac{3}{16}$″		Top and Bottom Roll Necks	(2) 938-932	Timken	1933-34
Cold Strip	3-High	2	3$\frac{7}{16}$″	9⅛″	9$\frac{3}{16}$″	Driver Harris Co., Harrison, N. J.				
Cold Strip	2-High		8″		10″		Top and Bottom Roll Necks	(2) 71450-71750	Timken	1934
Cold Sheet	4-High	1	16″	44″	84″	Eastern Rolling Mill Co., Baltimore, Md.	Backing Rolls	EE-662304-663550-51	Timken	1933
Cold Mill	2-High	1	8″		8″	Eastern Tool & Stamping Co., Saugus, Mass.	Roll Necks	(2) 759-752	Timken	1933
*Cold Strip	4-High	1	2¼″	20″	7½″	Edison Storage Battery Co., East Orange, N. J.	Backing Rolls	4146	Messinger	1934
*Cold Strip	4-High	1	3″	24″	18″	Elliott Brothers Co., New Castle, Pa.	Backing Rolls	3358-1	Messinger	1934

*Rolls, Frictionally Driven

COLD STRIP, SHEET AND TIN PLATE MILLS—*(Continued)*

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
*Cold Strip	4-High	1	5″	34″	38″	Follansbee Brothers Co., Follansbee, W. Va.	Backing Rolls	3975-2	Messinger	1934
Cold Strip	4-High	3	18″	46″	56″		Backing Rolls	EE-424257-424405-6	Timken	1934
							Work Rolls	EE-221028-221575-6	Timken	1934
Cold Strip	4-High	1	20½″	56″	84″	Ford Motor Company, Detroit, Michigan	Backing Rolls	EE-432301-432470-1	Timken	1935
							Work Rolls	EE-129121-129172-3	Timken	1935
Cold Skin Pass Mill	2-High	2	27″		56″		Roll Necks	EE-931170-931250-1	Timken	1935
Cold Strip	4-High	2	12″	28″	30″		Backing Rolls	EE-321146-321245	Timken	1933-34
							Work Rolls	(2) 82576-82950	Timken	1933-34
Cold Strip	2-High	1	20″		28″	Greer Steel Company, Dover, Ohio.	Roll Necks	EE-129121-129172-3	Timken	1934
Cold Strip	2-High	1	20″		22″		Roll Necks	B-1486-C	Bantam	1935
Cold Strip	4-High	1	13½″	30″	34″		Backing Rolls	B-1273-C	Bantam	1934
							Work Rolls 2 per polition	B-1384-A	Bantam	1934
Cold Mill	4-High	1	13½″	30″	30″		Backing Rolls	EE-623161-623265-6	Timken	1935
Cold Mill	2-High Tandem	6	4″		2″	Improved Seamless Wire Co., Providence, R. I.	Roll Necks	(2) 368-362	Timken	1934
*Cold Strip	4-High	1	8″	34″	38″		Backing Rolls	3971-1		
							Work Rolls	6268-2	Messinger	1933
Cold Mill	2-High	2	27″		48″	Inland Steel Company, Indiana Harbor, Ind.	Roll Necks	321146-321245	Timken	1932
Cold Strip	4-High	1	20″	44″	72″		Backing Rolls	I-321-C	Bantam	1934
Cold Strip	4-High	1	20″	44″	54″		Work Rolls	I-320-C	Bantam	1935
Cold Strip	4-High	1	18″	49″	42″		Backing Rolls	I-322-C	Bantam	1935
Planishing	4-High	2	18″	39″	42″		Backing Rolls	EE-525185-525321	Timken	1933
Cold Strip	Cluster	2	14″	24″	42″	International Nickel Co., Huntington, W. Va.	Backing Rolls	971352-972100-02	Timken	1930-31
*Cold Strip	4-High	1	2¼″	20″	7½″		Backing Rolls	2887-2	Messinger	1928
Cold Strip	4-High	1	16½″	53″	42″	Jones and Laughlin Steel Corp., Aliquippa, Pa.	Backing Rolls	EE-528301-528480-81		
							Work Rolls	(2) EE-93801-93125	Timken	1933
Cold Strip	4-High	1	5¼″	16″	12″	Newman Crosby Company, Pawtucket, R. I.	Backing Rolls	(2) 420800-421437	Timken	1934
							Work Rolls	(2) 469-453-x	Timken	1934
Cold Mill	2-High	1	8″		8″		Roll Necks	(2) 71450-71750	Timken	1935
Cold Strip	4-High	2	20½″	52″	72″	Otis Steel Company, Cleveland, Ohio.	Backing Rolls	532297-532445-46	Timken	1932
							Work Rolls Thrust End	129121-129172-73	Timken	1932
Cold Strip	Cluster	1	14″	27″	54″	Republic Steel Corp., Canton, Ohio.	Backing Rolls	261600-262500-01	Timken	1927
Cold Strip	Cluster	1	14″	27″	54″		Backing Rolls	R-220-C	Bantam	1934
Cold Strip	4-High	1					Work Rolls	CS-31099	Rollway	1929
Stainless Cold Strip	4-High	2	15″	32″	20″	Republic Steel Corp., Massillon, Ohio.	Backing Rolls	R-212-E	Bantam	1932
							Work Rolls	R-100-G	Bantam	1932
Cold Strip	4-High	1	9½″	24″	20″		Backing Rolls	941200-941950-51	Timken	1929
							Work Rolls	R-130-G	Bantam	1933
Cold Mill	2-High	1	20″		42″	Republic Steel Corp., Warren, Ohio.	Roll Necks	R-284-C	Bantam	1935
*Cold Strip	4-High	1	3″	24″	18″		Backing Rolls	3358-I	Messinger	1929
Cold Strip	4-High	1	18″	49″	42″		Backing Rolls	EE-428262-428420-1	Timken	1935
							Work Rolls	R-271-B	Bantam	1935
Cold Strip	4-High	1	10¼″	32″	38″		Backing Rolls	EE-924172-924289	Timken	1934
							Work Rolls	U-266-B	Bantam	1934
Cold Strip	4-High	6	14″	32″	42″		Backing Rolls	R-179-E	Bantam	1931
		2	14″	32″	42″		Work Rolls	R-100-G	Bantam	1931
Cold Strip	4-High	1	11½″	25″	16″	Rotary Electric Steel Co., Detroit, Michigan.	Backing Rolls	B-1290-C	Bantam	1934
							Work Rolls	(2) 82576-82950	Timken	1934
Cold Sheet	2-High	2	12″		10″		Roll Necks	R-286-B	Bantam	1934
Cold Mill	Tandem Cluster	4	10½″	21″	26″	Sharon Steel Hoop Co., Sharon, Pa.	Backing Rolls	941200-941950-51	Timken	1928
Cold Mill	Cluster	1	8½″	16½″	26″		Backing Rolls	221025-221575-76	Timken	1928
Cold Mill	Tandem Cluster	3	8½″	16½″	18″		Backing Rolls	221025-221575-76	Timken	1928
Cold Finishing	2-High	1	18″		26″		Roll Necks	221025-221575-76	Timken	1928
Cold Strip	2-High		10½″		18″		Roll Necks	CS-31046	Rollway	1928
Narrow Strip	2-High		8½″				Roll Necks	CS-31063	Rollway	1928
Narrow Strip	2-High		10½″		10″		Roll Necks	CS-31046	Rollway	1928
*Cold Strip	4-High	1	2¼″	20″	7½″	Signode Steel Strapping Company, Chicago, Illinois.	Backing Rolls	4146	Messinger	1930
Cold Strip	2-High	1	14″		14″	Stanley Works, New Britain, Conn.	Roll Necks	280700-281200-01	Timken	1930
Cold Strip	2-High	1	4″		4″		Roll Necks	S-565-A	Bantam	1934

*Rolls, Frictionally Driven

COLD STRIP, SHEET AND TIN PLATE MILLS—*(Continued)*

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
*Cold Strip	4-High	1	3″	24″	20″	Thomas Steel Company, Warren, Ohio.	Backing Rolls	3592-2	Messinger	1933
*Cold Strip	4-High	1	3″	20″	8½″		Backing Rolls	4146	Messinger	1935
Cold Strip	4-High	1	13½″	30″	34″		Backing Rolls Work Rolls	B-1273-C (2) B-1384-A	Bantam Bantam	1934 1934
Cold Strip	4-High	1	7″	19″	24″		Work Rolls Backing Rolls	CS-31064 551000-551700-01	Rollway Timken	1928 1930
Cold Mill	2-High	1	16″		24″		Roll Necks	420800-421450-51	Timken	1930
Cold Mill	2-High	1	10″		16″		Roll Necks	95499-95929	Timken	1930
Cold Strip	4-High	3	4½″	16″	12″		Backing Rolls	780702-781400	Timken	1929-31-32
Cold Strip	4-High	2	4½″	16″	12″		Work Rolls 2 per position	3780-3720	Timken	1931-32
Cold Strip	Cluster	1	4½″	9½″	8″	Thompson Wire Company, Boston, Mass.	Backing Rolls	74512-74850	Timken	1934
Cold Strip	4-High	1	6″	19″	16″	Universal Steel Company, Bridgeville, Pa.	Backing Rolls	B-1471-A	Bantam	1935
Cold Strip	4-High	1	7″	25″	16″	Wallingford Steel Co., Wallingford, Conn.	Work Rolls Thrust End 2 per position	6461-6420	Timken	1932
Cold Mill	2-High	1	14″		14″		Roll Necks	EE-210752-211300-01	Timken	1934
Cold Mill	3-High	1	7″	14″	14″		Middle Roll	579-D-572	Timken	1933
Cold Mill	2-High	1	14″		14″		Roll Necks	EE-210752-211300-01	Timken	1932
Cold Mill	2-High	12	8″		8″		Roll Necks	71426-71750	Timken	1934
Cold Mill	4-High	1	12″	33″	29″		Backing Rolls Work Rolls	EE-671798-672873-5 81601-81962-3	Timken Timken	1935 1935
Cold Mill	2-High Tandem	6	4″		2″	Waterbury-Farrell Company, Waterbury, Conn.	Roll Necks	(2) 368-362	Timken	1934
*Cold Strip	4-High	1	5″	32″	38″	Weirton Steel Company, Weirton, W. Va.	Backing Rolls	3367-2	Messinger	1930
*Cold Strip	4-High	1	3″	24″	20″		Backing Rolls	3592-2	Messinger	1932
*Cold Strip	4-High	1	4″	26″	28″		Backing Rolls	4166-2	Messinger	1933
Cold Strip	4-High	7	14″	32″	48″		Work Rolls	EE-9977-9920	Timken	1933-34
Cold Strip	4-High	1	18″	42″	38″		Backing Rolls Work Rolls	EE-725212-725356 EE-725213-725355 EE-324103-324160	Timken Timken Timken	1934 1935 1933
		4	18″	42″	38″					
Cold Strip	4-High	1	2″	11″	4″	Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	Backing Rolls	865-854	Timken	1930
Cold Strip	2-High	2	27″		48″	Wheeling Steel Corp., Steubenville, Ohio.	Roll Necks	321146-321245	Timken	1930
Cold Strip	4-High	5	18″	30″	32″	Wheeling Steel Corp., Yorkville, Ohio.	Backing Rolls Work Rolls	328172-328269 420804-421450	Timken	1930-35
Cold Strip	4-High	1	18″	39″	42″		Backing Rolls	EE-525185-525321	Timken	1935
Cold Mill	2-High	1	27″		48″		Roll Necks Roll Necks	321146-321245 EE-321147-321247	Timken Timken	1930 1934
Cold Mill	2-High	1	27″		48″		Roll Necks	W-537-C	Bantam	1935
Cold Strip	4-High	1	12″	32″	34″	West Leechburg Steel Co., West Leechburg, Pa.	Backing Rolls Work Rolls	EE-671798-672873-75 81601-81962-63	Timken	1935
*Cold Strip	4-High	1	3″	24″	20″		Backing Rolls	3592-2	Messinger	1935
*Cold Strip	4-High	1	3″	24″	20″		Backing Rolls	3592-2	Messinger	1935

ROD, RAIL, STRUCTURAL AND MERCHANT MILLS

Rod Mills	2-High		8″			American Steel & Wire Company, Cleveland, Ohio.	Roll Necks	CS-31036	Rollway	1928
Nut Stock	2-High		10″				Roll Necks	CS-31047	Rollway	1927
Rod Mill	2-High	1	12″				Roll Necks	EE-94713-94113	Timken	1935
Beam Mill	Side Roll	1				Bethlehem Steel Co., Bethlehem, Pa.	Vertical Flange Rolls	515060-515237	Timken	1930
Rail and Structural Mill	Side Roll	1				Bethlehem Steel Co., Steelton, Pa.	Side Rolls 2 per position	EE-117063-117148	Timken	1928
Rod Mill	2-High	1				Canadial Tube & Steel Products Ltd., Montreal.	Roll Necks	73550-73875-76	Timken	1931
Rod Mill	2-High		9¾″		10″		Roll Necks	I-28805-137603-I-34105-K	SKF	
Beam Mill	Universal	3	52″			Carnegie Steel Co., Munhall, Pa.	Vertical Rolls	141250-142550-51 141250-142651-52	Timken	1927-31
Bar Mill	2-High	4	21″			Great Lakes Steel Corp., Encorse, Michigan.	Roll Necks	722111-722185-86	Timken	1931
Bar Mill	2-High	6	18″				Roll Necks	551027-551662-63	Timken	1931
Bar Mill	3-High	2	18″				Roll Necks (2 per stand)	551027-551662-63	Timken	1931
Beam Mill	Universal	3	52″			Illinois Steel Company, South Chicago, Ill.	Vertical Rolls	141250-142651-142652	Timken	1931
Precision Bar Mill		1	10″				Vertical Rolls	I-312-A	Bantam	1935

*Rolls, Frictionally Driven

ROD, RAIL, STRUCTURAL AND MERCHANT MILLS—(Continued)

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
Structural Mill Feed and Back Stands	2-High	2				Kalman Steel Co., Buffalo, N. Y.	Roll Necks Left Roll Necks Right	(2) 74537-74850 (2) 71450-71750	Timken	1928
Structural Mill Main Slitting Stand	2-High	1					Roll Necks Upper and Lower Left Roll Necks Upper Right Roll Necks Lower Right	420800-421450 93800-93125 2 per position 99550-99100 2 per position		
Cotter Pin Mill	2-High	1				Page Steel & Wire Co., Monessen, Pa.	Top Roll Necks Bottom Roll Necks	581-D-572 687-672	Timken Timken	1934 1933
Rod Mill	2-High	1	20″		24″	Pittsburgh Crucible Steel Co., Midland, Pa.	Roll Necks	M-504-Q	Bantam	1935
Bar Mill	2-High	6	4″		4″	Rotary Electric Steel Co., Detroit, Mich.	Roll Necks	B-1303-A	Bantam	1934
Bar Mill	2-High	4	5″		4″		Roll Necks	B-1303-A	Bantam	1934
Billet Mill	3-High	2	28″			Timken Steel & Tube Co., Canton, Ohio.	Roll Necks	911601-912400-01	Timken	1929
Billet Mills	3-High	2	22″				Roll Necks	291200-291750-51		
Merchant Mills	2-High	6	16″		36″		Roll Necks Drive Side Roll Necks Opposite Side	130900-131400-01 130850-130900 131400-131401		
Merchant Mills	2-High	3	18″		36″		Roll Necks Drive Side Roll Necks Opposite Side	221025-221575-76 220975-221025 221575-221576		
Merchant Mills	3-High	1	16″		36″		Roll Necks Drive Side Roll Necks Opposite Side	130900-131400-01 130850-130900 131400-131401		
Vertical Mill	2-High	1	12″				Vertical Necks	73550-73875-76		

SEAMLESS, LAP, BUTT AND ELECTRIC WELD TUBE MILLS

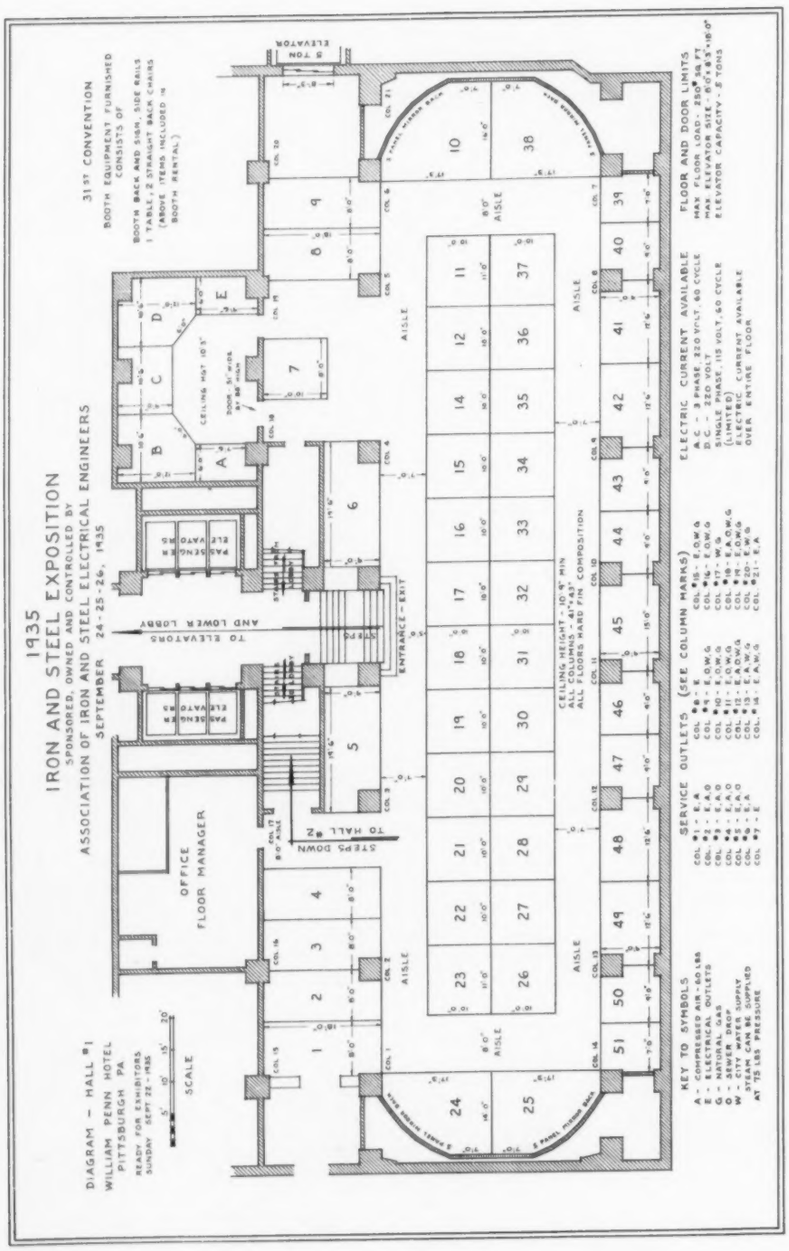
No. 1 Piercing Mill		1				Babcock-Wilcox Tube Company, Beaver Falls, Pa.	Main Rolls Piercing Ends	181452-182350-51	Timken	1931
No. 2 Disc Type Piercer and Elongator		1 1					Disc R. H. (2) Rolls L. H. (2) Cross Rear Rolls Front Disc R. H. (2) Rolls L. H. (2)	938-932 130900-131400 130900-131400 938-932 938-932	Timken	1934
No. 3 Disc Type Piercing Mill							Cross Rolls (2) Front Cross Rolls (2) Rear Disc Rolls (2) Right Hand Disc Rolls (2) Left Hand	EE-420801-421451 (2) EE-516050-516122 (2) 99600-99100 (2) 71450-71750	Timken	1934
Sizing Mills		5					Roll Necks	130900-131400		
Tube Elongator		1	21″		36″		Cross Roll Necks	130900-131400	Timken	1931
Reeler		2					Roll Necks	550988-551700-01		
Reducing Mill Special							Roll Necks	1-70302	SKF	
Lap Weld Tube Mill		1	6″		16″	Bethlehem Steel Co., Sparrows Point, Md.	Cross Roll Necks Lower Cross Roll Necks Upper Cross Roll Necks	99587-99100 4 per position 710900-711600 2 per position 710900-711600 2 per position	Timken	1927
Tube Welding Machine		3				Fretz Moon Tube Co., Butler, Pa.	Roll Shafts Inner Vert. Roll Shaft, Top & Bottom Outer Vert. Roll Shaft, Top Vert. Roll Upper Vert. Roll Lower Horizontal Roll Left Hand Horizontal Roll Right Hand	74500-74850 2 per position 861-854 1 per position 861-854 1 per position 558-552-A 2 Bearings 3982-3920 2 Bearings 558-552-A 2 Bearings 3982-3920 2 Bearings	Timken	1927
½″ Butt Tube Welding Machine		3								

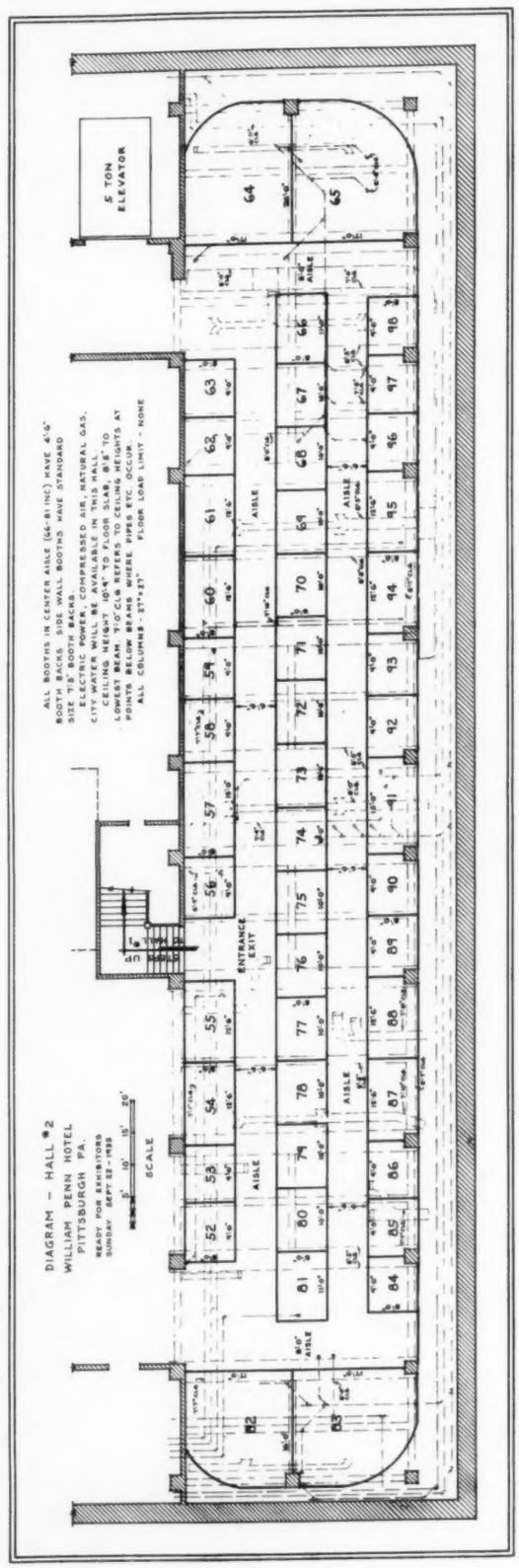
SEAMLESS, LAP, BUTT AND ELECTRIC WELD TUBE MILLS—(Continued)

MILL	TYPE	NO. OF STANDS	ROLL DATA WORK ROLL	ROLL DATA BACKING ROLL	ROLL DATA BODY LENGTHS	WHERE OPERATING	POSITION OF BEARING	BEARING NUMBER	BEARING MFG.	YEAR INSTALLED
Piercing Mill			27″			Globe Steel Tubes Co., Milwaukee, Wisconsin.	Journal	22344-X	SKF	
Reeling Mill			28″				Journal	22338	SKF	
Reeling Mill			24″				Journal	22336	SKF	
Gauging Mill			12″		6″		Journal	1-26303	SKF	
Tube Sizing Mill		23 rolls	4½″			Jones & Laughlin Steel Corp., Aliquippa, Pa.	Roll Necks	462-452-D	Timken	1933-34
Push Bench Sizing Mill	Vertical Rolls	2					Roll Necks 2 per position	99587-99100	Timken	1931
Tube Sizing Mill		2	4½″				Mandrel, Rt. Hand Left Hand	2-R-462-452-D 2-R-567-563-D	Timken	1934
Reducing Mill	Special						Roll Shaft	W.U.L.-32211	SKF	
Butt Weld Sizing Mill	2-High	1				Laclede Tube Company, Alton, Ill.	Overhung Sizing Roll	861-854	Timken	1930
Piercing Mill		1	24″			National Tube Company, Ellwood City, Pa.	Main Rolls	N-193-B	Bantam	1933
Hot Elongator		1	24″				Guide Discs	N-194-B	Bantam	1933
								EE-153050-153101	Timken	1935
Reeling Mill			36″			National Tube Company, Gary, Indiana.	Journal	22352-X	SKF	
No. 4 Lap Weld		1					Roll Necks	280700-281200-01	Timken	1928
Reel Mill		2	24″			National Tube Company, Lorain, Ohio.	Roll Necks	N-239-C	Bantam	1933
Hot Elongator		1	24″		43″	Pittsburgh Steel Co., Allenport, Pa.	Roll Necks	EE-721092-721162	Timken	1934
Piercing Mill		1	34″			Timken Steel & Tube Co., Canton, Ohio.	Driven End	941202-941950	Timken	1929
							Opposite End	941102-941950		
Return Mill		1	26″				Roll Necks	231401-232025-26		1929
Reelers		2	26″				Roll Necks	280701-281200-01		1929
Reducing Mills		33	12″				Roll Necks 99587-99100 2 per position			1927
							Driven End	941202-941950	Timken	1929
Piercing Mill		1	36″				Opposite End	941102-941950		1929
Return Mill		1	26″				Roll Necks	231401-232025-26	Timken	1929
Reelers		2	30″				Roll Necks	550988-551700-01		1929
Reducing Mills		42	16″				Roll Necks	280700-281200		1929
Stainless Tube Reducing Mill		1	1½″				Top and Bottom Rolls Right and Left	NA-82587-82932	Timken	1935
Stainless Tube Reducing Mill		1	2½″				Top and Bottom Rolls Right and Left	8975-D-8920-8920-D	Timken	1935
3¼″ Piercing Mill		1	14″				Cross Coup. End Rolls Del. End	81602-81962-63-D 81577-81962-63-D	Timken	1935
Three Roll Elongator		1				Timken Steel & Tube Co., Wooster, Ohio.	Roll Neck Fixed End	861-854-D	Timken	1934
Three Roll Tube Sizing Machine		1					Roll Necks Front & Rear	779-D-772	Timken	1935
Butt Weld Tube Sizing Mill	2-High	1				Wheatland Tube Co., Sharon, Pa.	Roll Necks Right Hand 2 per position	94650-94113		
							Roll Necks Left Hand 2 per position	95500-95925	Timken	1931
Butt Weld Tube Sizing Mill	2-High	2				Youngstown Sheet & Tube Co., Indiana Harbor, Ind.	Roll Necks Left Hand 2 per position	95500-95925	Timken	1929
							Roll Necks Right Hand 2 per position	94650-94113		
Electric Weld Tube Forming Mill	2-High	15	24″				Roll Necks	291201-291750 2 per position		
							Vertical Sizing Roll Top	99587-99100	Timken	1930
							Vertical Sizing Roll Bottom	99600-99100		
							Horizontal Siz. Rolls	181451-182350	Timken	1930
							Small Sizing Roll	462-453-A		
Electric Weld Straightening		1	24″			Youngstown Sheet & Tube Co., Youngstown, Ohio.	Straightening Rolls	430900-431575 2 per position	Timken	1930
							Forming Rolls	(2) 99550-99100		
Electric Weld Tube Forming Mill		3					Guide Rolls Top R. & L. Hand	755-752		
							Guide Rolls Bottom L. & R. Hand	99600-99100	Timken	1934
							Welding Rolls, Top	99600-99100		
							Welding Rolls Bot.	EE-526130-526190		

FLOOR PLANS—IRON AND STEEL EXPOSITION

PITTSBURGH, SEPTEMBER 24-25-26-1935


1935
IRON AND STEEL EXPOSITION
SPONSORED, OWNED AND CONTROLLED BY
ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS
SEPTEMBER 24-25-26, 1935
31ST CONVENTION
BOOTH EQUIPMENT FURNISHED CONSISTS OF
BOOTH BACK AND SIDE RAILS
1 TABLE, 2 STRAIGHT BACK CHAIRS
(ABOVE ITEMS INCLUDED IN BOOTH RENTAL)
DIAGRAM – HALL #1
WILLIAM PENN HOTEL
PITTSBURGH PA.
READY FOR EXHIBITORS SUNDAY SEPT 22 - 1935
SCALE
OFFICE
FLOOR MANAGER
TO HALL #2
STEPS DOWN
TO ELEVATORS AND LOWER LOBBY
ENTRANCE – EXIT
5 TON ELEVATOR
AISLE
CEILING HEIGHT - 10'-6" MIN
ALL FLOORS HARD PIN COMPOSITION
KEY TO SYMBOLS
A - COMPRESSED AIR - 60 LBS
E - ELECTRICAL OUTLETS
G - NATURAL GAS
O - SEWER DROP
W - CITY WATER SUPPLY
STEAM CAN BE SUPPLIED AT 75 LBS PRESSURE
SERVICE OUTLETS (SEE COLUMN MARKS)
ELECTRIC CURRENT AVAILABLE
A.C. - 3 PHASE 220 VOLT, 60 CYCLE
D.C. - 220 VOLT
SINGLE PHASE, 115 VOLT, 60 CYCLE (LIMITED)
ELECTRIC CURRENT AVAILABLE OVER ENTIRE FLOOR
FLOOR AND DOOR LIMITS
MAX. FLOOR LOAD - 250 LBS PER SQ. FT.
MAX. ELEVATOR SIZE - 8'-0" x 8'-3" x 10'-0"
ELEVATOR CAPACITY - 5 TONS
FLOOR LOAD LIMIT - NONE
ALL COLUMNS - 27"x27"


5 TON ELEVATOR
ALL BOOTHS IN CENTER AISLE (66-81 INC) HAVE 4'-6" BOOTH BACKS. SIDE WALL BOOTHS HAVE STANDARD SIZE 7'8" BOOTH BACKS.
ELECTRIC POWER, COMPRESSED AIR, NATURAL GAS, CITY WATER WILL BE AVAILABLE IN THIS HALL.
CEILING HEIGHT 10'-6" TO FLOOR SLAB, @ 8'-6" TO LOWER BEAM. TO CLG REFERS TO CEILING HEIGHTS AT POINTS BELOW BEAMS. PIPES ETC. CLEAR
ALL COLUMNS - 27"x27"
FLOOR LOAD LIMIT - NONE
DIAGRAM – HALL #2
WILLIAM PENN HOTEL
PITTSBURGH PA.
READY FOR EXHIBITORS SUNDAY SEPT 22 - 1935
SCALE
ENTRANCE EXIT
AISLE

▲ ▲ ▲ ITEMS OF INTEREST ▲ ▲ ▲

B. F. Fairless, Executive Vice-President of the Republic Steel Corporation, has resigned this position to head the newly organized group operating and sales plan of the Carnegie Steel Company and Illinois Steel Company. His resignation will become effective September 16th.

After graduating from college as a civil engineer, Mr. Fairless became affiliated in 1914 with the Central Steel Company, Massillon, Ohio. Progressing through various departments of this company to the position of vice-president and general manager which he held until the Central Steel Company was merged with United Alloy Steel Corporation, Canton, Ohio. This new combine was named the Central Alloy Steel Corporation and Mr. Fairless subsequently became its chief executive.

In 1929 when Republic Steel absorbed this company, Mr. Fairless was made the executive vice-president of the Republic Steel Corporation.

R. J. WYSOR

Following the resignation of B .F. Fairless from the Republic Steel Corporation, R. J. Wysor, Vice-President, in charge of operations, was elected the new executive vice-president and general manager.

A graduate of Virginia Polytechnic Institute, as a chemist and metallurgist, Mr. Wysor has been almost continuously in the steel business during the past twenty-nine years. Starting with the Carnegie Steel Company as a chemist, he subsequently became chief chemist of the Bethlehem Steel Company, Bethlehem; superintendent of the Bethlehem blast furnaces and from there to the position of superintendent in charge of the service division. In 1919 he was made assistant general manager of the Sparrows Point plant. In 1923 when Bethlehem acquired the Cambria Steel Company, Johnstown, Pa., he was made the assistant general manager.

Two and a half years later Mr. Wysor went with the Jones and Laughlin Steel Corporation as assistant general manager. When T. M. Girdler was elected president of this Company in 1928, Mr. Wysor succeeded him as general manager.

Late in 1929 when the Republic Steel Corporation was organized he joined this Company as the vice-president in charge of operations.

C. M. WHITE

To succeed R. J. Wysor as vice-president in charge of operations, C. M. White, his assistant, and a member of the Republic organization since 1930, was appointed.

A graduate of Maryland State College, Mr. White's first position in the steel industry was that of a machinist helper with the American Bridge Company at Ambridge, Penna.

Soon thereafter he left this company to associate himself with the Jones and Laughlin Steel Corporation. After two years with this company he was made the assistant blast furnace superintendent of the Eliza works and then master mechanic in charge of construction and power. He next went to the company's South Side works as assistant to the general superintendent in charge of all mechanical and construction work.

In 1927 Mr. White was appointed assistant general superintendent of the Aliquippa works and two years later was made general superintendent. When the Republic Steel Corporation was organized late in 1929 Mr. White left Jones and Laughlin to become the assistant vice president in charge of operations.

▲

Earl F. Blank, an active member of our association, has been appointed director of the recently created personnel relations department of the Jones & Laughlin Steel Corporation it was announced by officials of the corporation.

Prior to joining the J & L organization as director of the Safety and Welfare Department in 1925, Mr. Blank was engaged in accident prevention and personnel administration with the Ford Motor Company from 1915 to 1918, then with the Buick Motor Company until 1923 when he was transferred to supervise the safety work of the General Motors Corporation.

▲

Three promotions in the organization of Allegheny Steel Co. were announced recently by W. F. Detwiler, executive vice president of the company. W. A. Givens, formerly general superintendent, becomes general manager; A. E. Miller, formerly assistant general superintendent, becomes general superintendent; and M. C. Harris, formerly manager of the service department, becomes assistant general manager.

▲

At a meeting of the board of directors of the Blaw-Knox Company on August 26th, E. R. Crawford, president of the McKeesport Tin Plate Company, was elected a director of the Blaw-Knox Company.

▲

The Timken Steel & Tube Company, Canton, Ohio, announces the election of Frank L. Gibbons as Vice President in charge of Sales. Mr. Gibbons is widely known in alloy steel circles, having been associated with The Timken Steel & Tube Company as Director of Sales since 1932 and prior to that with the Crucible Steel Company, the old Carbon Steel Company, Central Steel Company, Central Alloy Company and Republic Steel Corporation, having entered the sales end of the steel business in 1908.

▲

F. C. T. Daniels, chief metallurgist of the Mackintosh-Hemphill Company, of Pittsburgh, sailed from New York August 21 on the President Harding, en route to London, where he will join other officials of the Pittsburgh concern in a series of conferences with British, French, German and Belgian users of American-designed rolling mill equipment.

Col. J. S. Ervin, president, and F. H. Moyer, vice president in charge of engineering of the Mackintosh-Hemphill Company, have been in England since early August, meeting with representatives of European companies which are interested in applying in their countries recent American developments in the design and construction of metal-working machinery. Mr. Daniels will join them as a consultant on metallurgical phases of projects which have developed during their visit.

▲

Because of the rapidly increasing use of rolled steel in machine construction, the Illinois Steel Company and the Carnegie Steel Company have collaborated in the preparation of a new technical booklet entitled "Rolled Steel for Machine Construction".

This new well illustrated, 16 page booklet is one of the most complete works of its kind ever offered to cover this new field. For executives and production men, it contains valuable suggestions on the forms of steel available, short cuts to economy in buying, how rolled steel and castings may be combined, suggestions on welding technique, stress relief, etc. Copies will be sent gratis to all interested parties upon application to either company.

Lorenz Iverson, President of Mesta Machine Company, Pittsburgh was recently presented the Pennsylvania Manufacturers' Association Safety Trophy by John M. Flynn, President of the Manufacturers' Association. The presentation was made at the company's annual picnic and Ex-Governor John K. Tener delivered an address on safety.

▲

Beginning August 26, a special five day course in welding engineering is being offered in Cleveland by the John Huntington Polytechnic Institute in cooperation with The Lincoln Electric Company. The course, being repeated at this time due to increased activity in the welding industry and in answer to a demand for an intensive advanced welding training course, will be conducted once each month, except during November, through May 1936. Engineers, welding supervisors and foremen will have an opportunity to engage in intensive study of both the practical and theoretical sides of arc welding. In view of the great interest in past sessions of this course, a full enrollment is anticipated for each of the weekly periods.

▲

The latest edition of the General Electric bulletin GEA-1278B on paper-insulated cable is now ready for distribution. This new bulletin describes, in detail, four major improvements—compack-strand conductor, paper insulation applied in graduated layers, treatment with carbon-dioxide gas, and hydrogen-processed lead-sheath.

In addition, the four general types of paper-insulated cable—oil-filled, shielded Type H, nonshielded, and Pyranol—are described in detail. Insulation thicknesses and other data are also included.

This is a companion book to the following General Electric publications:

GEA-1837—How to Select Insulated Cable, GEA-1839—Cable Accessories, and GEA-1731—How to Make Cable Joints. GEA-1837 is, at present, out of print, but copies of the other two books are available.

▲

Contracts, for railway equipment, in excess of $2,000,000 have been awarded to the Westinghouse Electric & Manufacturing Company for the Board of Transportation of New York City.

The Westinghouse award is for motive power, control units and other accessories to be installed on new subway cars ordered for service on city-operated lines in New York. The equipment will be placed on cars built by the American Car & Foundry Co., the Pullman-Standard Car Manufacturing Company, and the Pressed Steel Car Company. 500 new cars have been ordered from these builders to increase existing equipment and to extend service on the Eighth Avenue and connecting subway lines. The contract for new cars exclusive of electrical equipment is the largest order placed for railway equipment since 1931.

Equipment to be supplied by Westinghouse will include 190-horsepower traction motors, multiple-unit

(*continued on page 86*)

FUSES MADE TO *protect* ...NOT TO BLOW

Copyright, 1935
BUSSMANN MFG. CO., St. Louis, Mo.
A Division of McGraw Electric Company

(PROOF AVAILABLE)

control for operation of eight to ten unit trains, battery charging panels and car ventilating fans. More than 2000 fans, of the ceiling mounted type, have been ordered from Westinghouse for the new cars.

Work on the contracts will be started immediately at East Pittsburgh with deliveries scheduled at short intervals, so that the new transportation equipment may be placed in operation on New York City lines as soon as possible. Power generating equipment, including mercury arc rectifiers, purchased from Westinghouse recently, will furnish power for these new cars.

▲

The A. M. Byers Company, have just announced to the trade the third major expansion project for this company in recent years.

Several years ago Byers completed the largest and most modern wrought iron mill in the country at Ambridge, Pa., for manufacturing genuine wrought iron under their new process. Following this, the operations were further expanded to include the reintroduction of a wide range of wrought iron products which includes plates, sheets, merchant bars, angles, structurals, and forging billets.

The third step in broadening the sales and manufacturing activities of the company was taken when Mr. J. Frederic Byers, Chairman of the Board, announced recently that Byers Steel Pipe would be manufactured in addition to the present complete line of wrought iron products. Byers Steel Pipe will be made in the company's modern pipe mills under the same executive supervision as exists on wrought iron pipe.

▲

A $10,000,000 project to provide the Ford Motor Company with new hot strip steel rolling mills and sheet steel cold finishing mills is entering the final stage at the Ford Rouge Plant at Dearborn, Mich., company officials announced.

The building program, costing $650,000, has been completed, and it is expected that new machinery, now being installed, will be ready to operate in September. Machinery and motor equipment required in the mills will weigh in the neighborhood of 20,000,000 pounds.

To support some of the larger mill stands, it was necessary to sink concrete caissons 100 feet deep, tying them into bed rock. The Ford steel production program, which will increase the Detroit area steel production capacity by 1,500 tons a day, or 25 percent, contemplates the casting of 4,500-pound and 10-ton ingots in place of the 1,500-pound ingots now being cast for rolling in the present bar mills. Two enlarged soaking pits are being prepared to handle the cold 20,000-pound ingots, while the 4,500-pound and 20,000-pound hot ingots will be treated in the present pits.

▲

Bethlehem Steel has contracted with Surface Combustion for complete Radiant Tube Annealing Equipment for the new wide strip mill at Lackawanna, New York.

The contract includes all the necessary annealing equipment consisting of Radiant Tube Annealing covers, inner covers and bases together with the auxiliary equipment.

The installation will be the largest of its kind and is unique in that it will be fired with a 300 B.T.U. mixture of blast furnace and coke oven gas. The installation is, perhaps, of greater interest due to the fact that it represents another milestone in annealing methods in steel production, as all the annealing equipment in this modern mill operates under controlled atmospheres.

The atmosphere is supplied by three 15,000 cubic feet per hour Surface Combustion DX Gas Producing Machines. The same kind of gas used for heating the Radiant Tubes is deoxidized in these units. This again is a new application of this mixture of gases, an advancement that means interesting economies.

Bethlehem has also contracted with Surface for complete Radiant Tube Annealing equipment for the new Tin Plate Mill at Sparrows Point. These furnaces are of the double row type having Radiant Tubes on both sides and center. Each cover will accommodate eight piles of coils arranged four on each side of the center row of Radiant Tubes.

▲

The new Carnegie Steel Company Rolling Mill, to be erected at Homestead, Pa., will be a 100″ semi-continuous, electric driven, sheared plate mill, located between the present 110″ (Liberty Mill) and the Pittsburgh and Lake Erie Tracks, West Homestead, Pa., covering an area of 1800 by approximately 300 feet over all, with a floor area under roof of 404,210 square feet (approximately 9¼ acres).

The mill will consist of the following:—

Four Continuous Type Re-heating Furnaces.
One 36″ x 100″, Two High, Non-reversing Scale Stand.
One 42″ and 52″ x 120″, Four High, Spreading Stand.
One Slab Squeezer.
One 36″ and 54″ x 100″, Four High, Reversing Roughing Stand with Vertical Edging Stand.
Four 27″ and 54″ x 100″, Four High, Continuous Finishing Stands with Shears and Normalizing Equipment.

The average slab used by the mill will be 54″ x 6″ x 90″ and the finished product will measure 20″ to 90″, inclusive in width by $\frac{3}{32}$″ to ¾″, inclusive in gauge. The product will range from standard carbon steel to high tensile steels, such as United States Steel Corporation Cor-Ten, Man-Ten and Sil-Ten. The rated capacity of the mill is 728,900 gross tons per year.

▲

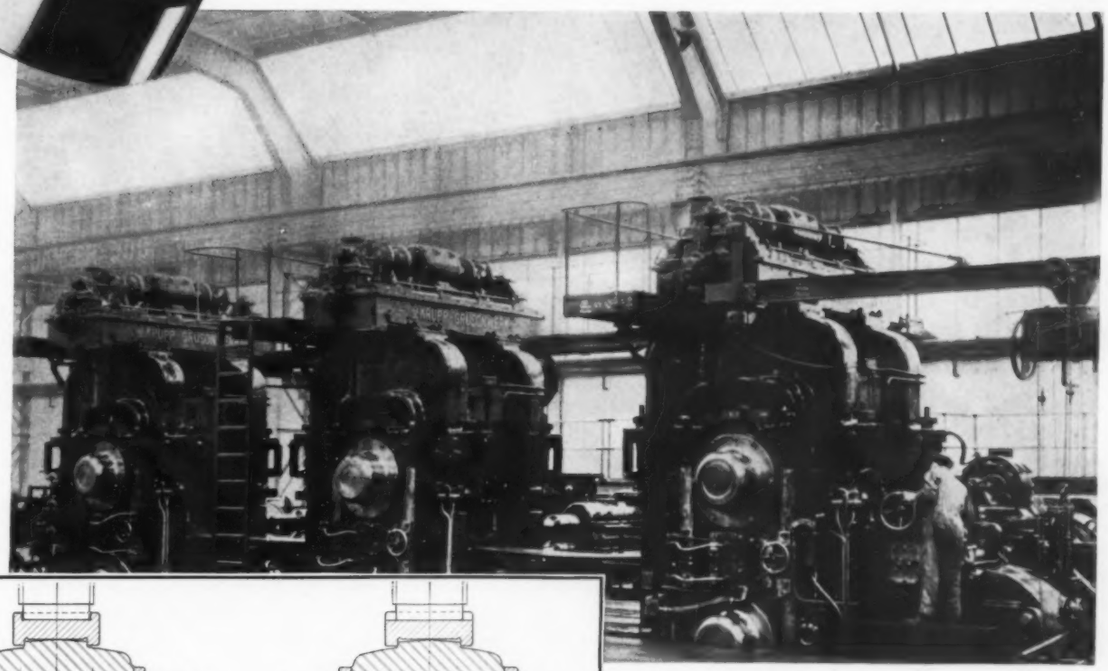
OBITUARIES

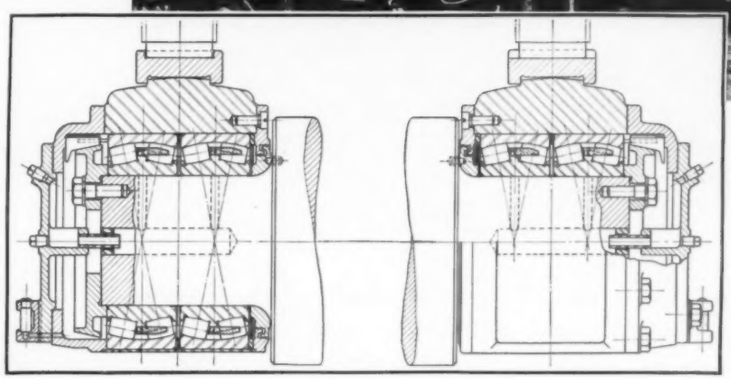
It is with deep regret that the association announces the death of J. H. Hall, Assistant Chief Engineer of the Electric Controller and Manufacturing Company. His death occured on August 21. Mr. Hall had been an associate member of our society for 8 years.

▲

Thomas J. Muir, director of sales of the Morgan Engineering Company died at his home August 6. He spent his early years in Cleveland and entered the employ of the Morgan Engineering Company in 1902, entering the sales department in 1907, In 1927 he was made assistant sales manager holding this position until June 1, 1931 when he was made director of sales.

Long Life · · Quality · · High Tonnage On SKF Bearings





SKF-Equipped 31 ½" x 10" 4-High Continuous Cold Rolling Mill Built by Fried. Krupp-Grusonwerk, A.G., Magdeburg-Buckau, Germany.

ROLLING MILL operators and designers can't afford to gamble with bearings. Good bearings are most important in the steady production of quality tonnage.

Mill men don't take chances when they specify SKF Roll-Neck Bearings. For the exclusive SKF design provides self-alignment, equalized load distribution, full bearing capacity and long life.

More than 1200 SKF-equipped stands prove the confidence of men who design, make, and operate steel mill machinery. SKF will bring efficiency to your stands, too, if you specify them.

SKF INDUSTRIES, INC., Front St. and Erie Ave., Philadelphia, Pa.

More Than 1200 Stands SKF EQUIPPED

3463

SKF
ROLLER BEARINGS

FOUNDED IN 1890

A. S. SCHULMAN ELECTRIC COMPANY
LECTRICAL ENGINEERS & CONTRACTORS
537 SOUTH DEARBORN STREET
CHICAGO

A. S. SCHULMAN, PRESIDENT
HARVEY T. NACK, VICE PRESIDENT

PHONE HARRISON 7288

March 7, 1935.

OKONITE

42 YEARS in the GREAT NORTHERN

The Okonite Company
Mr. C. E. Brown
20 North Wacker Drive
Chicago, Illinois

My dear Mr. Brown:

It may be of interest for you to know that we are now engaged in re-wiring the Great Northern Hotel. In doing so we are finding old wires nailed to the brick walls and terra cotta ceilings, samples of which are enclosed herewith. In removing these samples I recognized them as belonging to our old friends "OKONITE". These wires are still in good shape and they perhaps would last a number of years.

Judging from the installation this material must have been used and used for over forty-two years. We can furnish you with more samples if you so desire.

Very truly yours,

A. S. SCHULMAN ELECTRIC COMPANY

AS:HJK BY A. S. Schulman

THE OKONITE COMPANY

Founded 1878
and

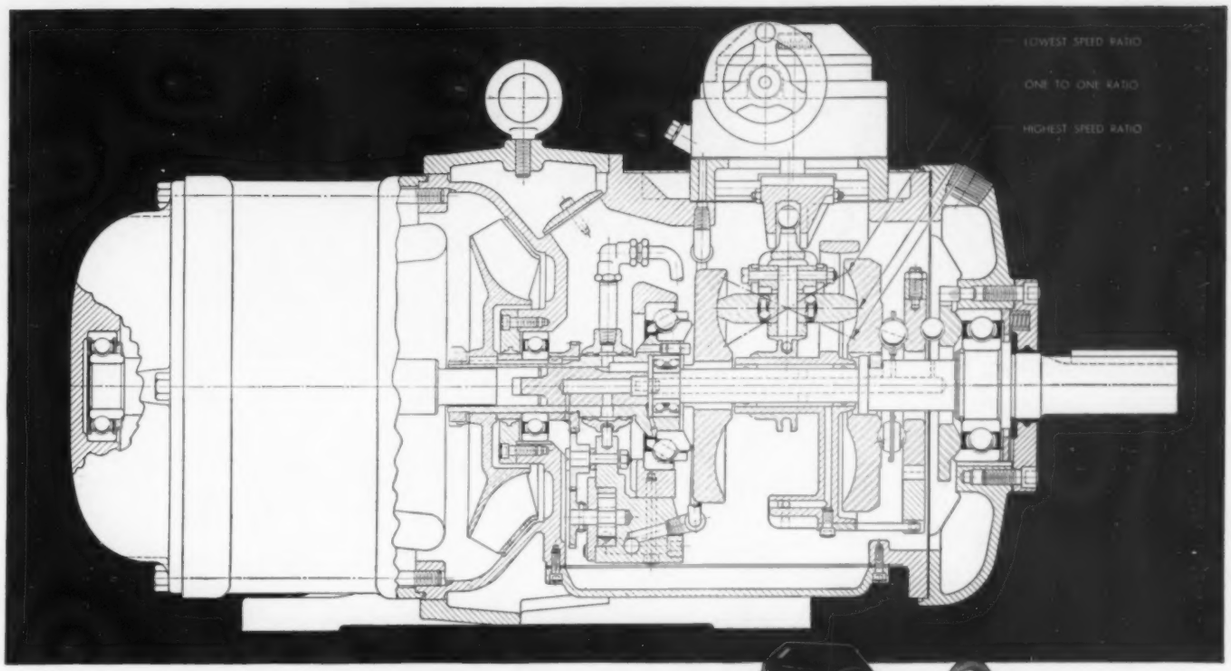
HAZARD INSULATED WIRE WORKS DIVISION

THE OKONITE-CALLENDER CABLE COMPANY, INC.

EXECUTIVE OFFICE: PASSAIC, N. J.

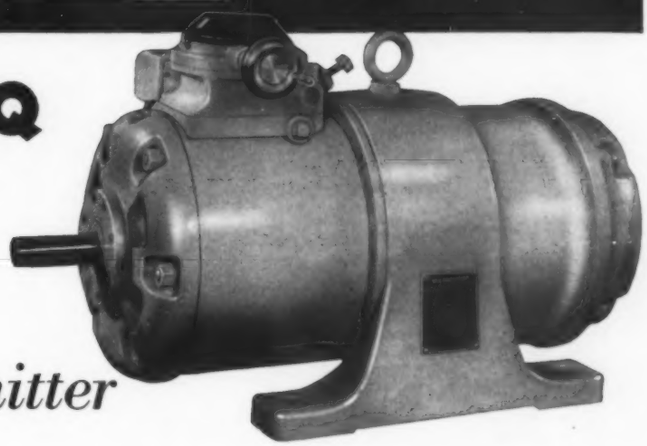
New York, Philadelphia, Los Angeles, Boston, Pittsburgh, Seattle, Chicago, Washington, Dallas, Detroit, San Francisco, Atlanta

Factories: Passaic, N. J. Wilkes-Barre, Pa. Paterson, N. J.



TRANSITORQ

A truly simple highly efficient variable speed transmitter



● A constant speed electric motor and *infinitely adjustable speed* transmission combined in one exceedingly compact, fully enclosed unit.

Speed ratio 6 to 1. ▲ Positive drive under all conditions, including shock load, rapid reversing or extreme overload.

Speed may be selected before starting or changed while running. ▲ Time required to change up or down to any desired speed adjustable over wide range.

Automatically shifts to low-speed, high-torque position whenever stopped. Prevents overloading of motor when starting.

Speed control easily arranged to take care of machines requiring non-uniform or irregularly timed speed changes. ▲ Direct or remote fingertip control of speed for any kind of installation.

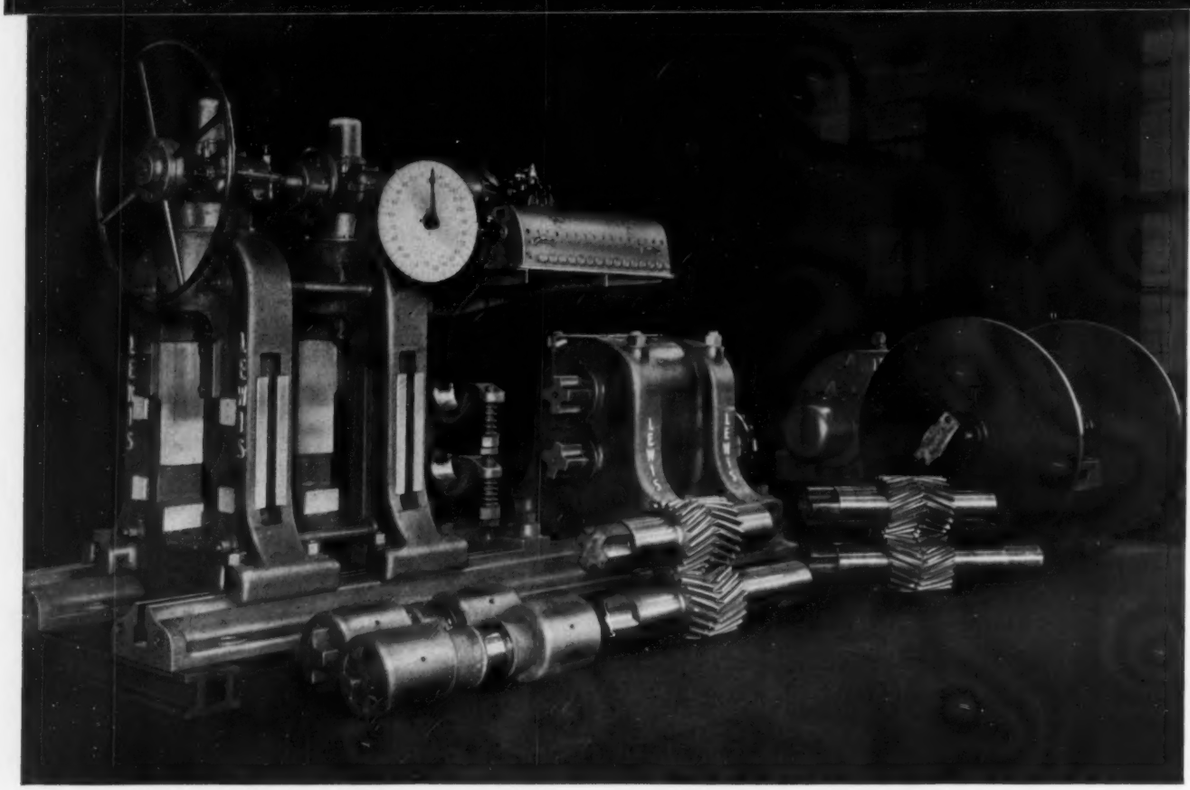
Adaptable to any mounting position, vertical or horizontal, sidewall, ceiling or floor. ▲ Completely New Departure Ball Bearing-equipped. Rolling parts inherently in balance, assuring long life, quiet operation and freedom from vibration at all speeds.

Ask for Catalog PL containing a detailed description of the Transitorq. The New Departure Manufacturing Company, Bristol, Conn.

NEW DEPARTURE
Variable Speed
POWER UNIT

LEWIS

ZINC STRIP ROUGHING MILL



Here is a LEWIS Zinc Strip Roughing Mill with motor operated screwdown and automatic control of reductions of each pass.

This mill is similar to a Zinc Strip Mill recently built by LEWIS and shipped to the Ever Ready Company, in England.

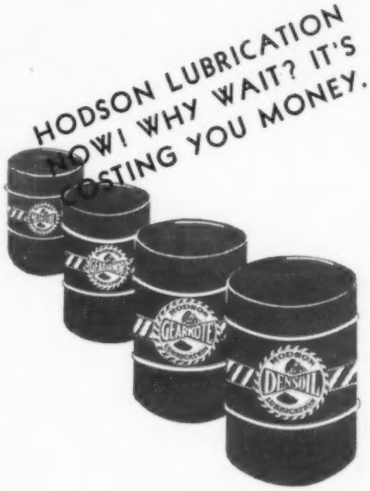
Zinc Strip Roughing Mills are manufactured complete in the Lewis shops.

LEWIS FOUNDRY & MACHINE CO.
PITTSBURGH, PA.

DENSOIL • GEARKOTE • GEARARMOR • METALICOIL

The 'FOUR HORSEMEN'

of Steel Mill Lubrication



- Equipment supported by these lubricants results in more economical operation and greater efficiency through power savings, less wear, less care and attention, lower maintenance and extended life.
- We offer you the benefit of our personal, practical experience and our services as consultants on your lubrication problems, without obligation or charge.
- **THE ADAMS-SCHUETTE LUBRICATING SYSTEM'S . . .** efficiency - in all Lubrication factors - is established by eight years of continuous, heavy duty service.
- **You will find our Iron & Steel Exposition Exhibit in Booth No. 83, Hall No. 2, interesting and instructive.**

THE HODSON CORPORATION

Lubrication Engineers & Manufacturers

5301-11 WEST 66TH STREET • PHONE HEMLOCK 2676 • CHICAGO, ILLINOIS

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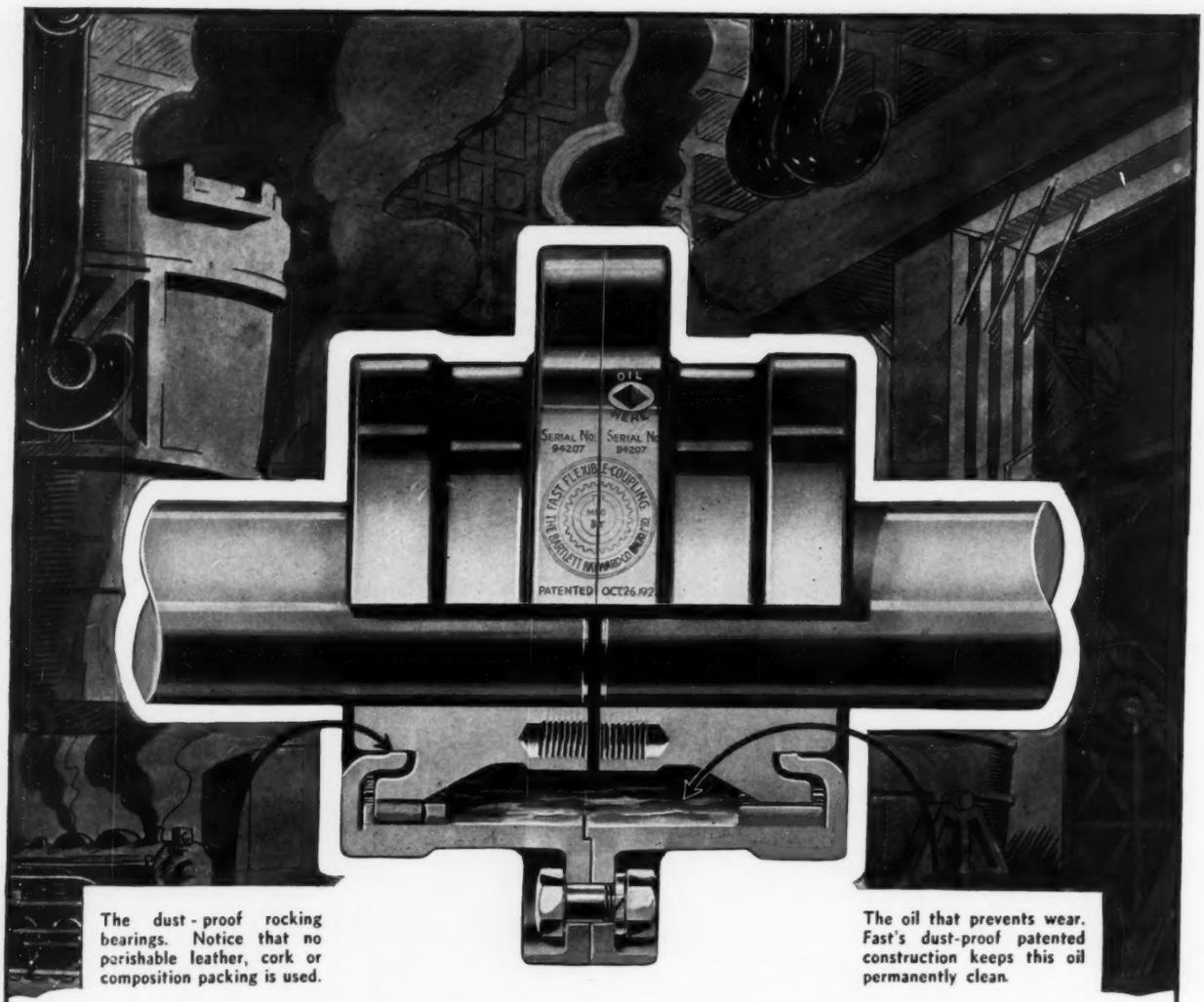


The dust-proof rocking bearings. Notice that no perishable leather, cork or composition packing is used.

The oil that prevents wear. Fast's dust-proof patented construction keeps this oil permanently clean.

Sound Reasons Why FAST'S COUPLINGS are the *STANDARD*

IT has not been by chance that engineers in steel mills have chosen Fast's Self-Aligning Couplings. Trouble-free operation throughout the life of the connected machines has emphasized their superiority.

1. Fast's Couplings are protected by a cushion of oil. There is no metal-to-metal contact, therefore no wear.
2. The rocking bearings that support the floating sleeve are located at the only points where they will make effective dust-proof seals. Fast's patents cover this vital feature.
3. The only attention required is oiling.
4. Fast's construction is all-metal. No perishable leather, cork or composition packing is used.
5. Fast's service is available in every part of the country.
6. Fast's established standards of accuracy and workmanship and The Bartlett Hayward Company guarantee.

When specifying couplings on machinery you purchase, be sure you get genuine Fast's. No other can give you these advantages.

THE BARTLETT HAYWARD CO.
BALTIMORE, MARYLAND

Price of Set
(as illustrated)
$175.00

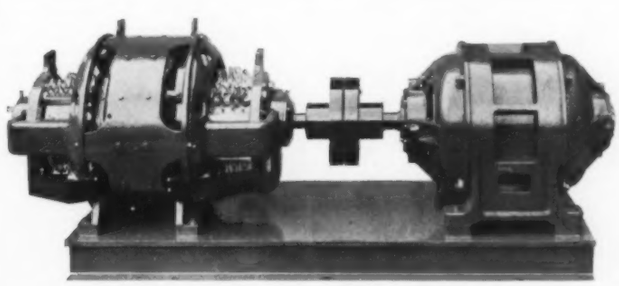
Measures A.C. or D.C. Current Up to 400 Amperes --Instantly ▪ Accurately ▪ Safely

Tong Tests, the revolutionary current measuring instruments which make readings right through insulated cable, are now available in sets to suit operating conditions from 0 to 800 amperes.

The set shown above, for example, accurately measures up to 400 amperes, and consists of one pocket Tong Test for current readings of 0-20 amperes; one Type "AX" Tong Test with three movement units, 0-50, 0-200, 0-400 amperes; with two leather carrying cases. The three movement units for the Type "AX" instrument are interchangeable in from 5 to 10 seconds.

Compare former methods of current measuring — where a number of transformers, ammeters of different scales, leads, connectors, etc., were necessary — with Tong Test. Compare the weight, the delays and the ability to make readings in inaccessible places, with the light weight (2¾ pounds) Tong Test.

The Tong Test bulletin completely describes these ammeters and names some of the companies who use them. May we send you a copy, without obligation?



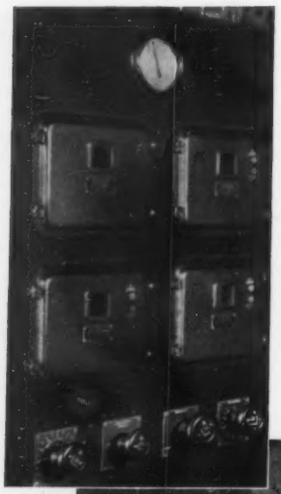
Many of the country's leading steel plants are users of Columbia equipment for electroplating and similar processes. Columbia Generators can be furnished in sizes from 100 to 20,000 amperes. Complete synchronous or induction-type motor generator sets can also be furnished. Literature on request.

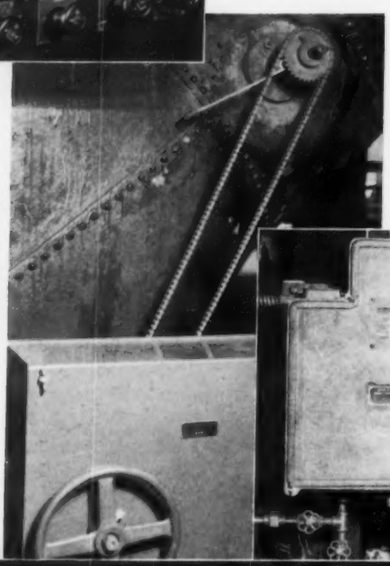
THE COLUMBIA ELECTRIC MFG. CO.
4505 Hamilton Ave., Cleveland, Ohio
In Canada: Bepco Canada, Ltd., Montreal

COLUMBIA

TONG TEST AMMETERS

L&N OPEN HEARTH





Typical L & N equipment in use on open hearth controls. Top, Metermax Unit Combustion Control Panel; left, Drive Unit on stack damper; below, L & N Furnace Pressure Controller.

THE L & N Open Hearth Control System, fully automatic, consists of four separate but closely inter-related controls: combustion, furnace pressure, automatic reversal, roof temperature. Although any one control may be used alone, outstanding benefits are obtained when they are tied together . . . so that all factors involved in an adverse change can be readjusted at once.

Combustion Control proportions air and fuel for the desired efficiency at the burners. Operator sets a fuel-air ratio rheostat, after which ratio is automatically maintained. Losses are thus held at minimum.

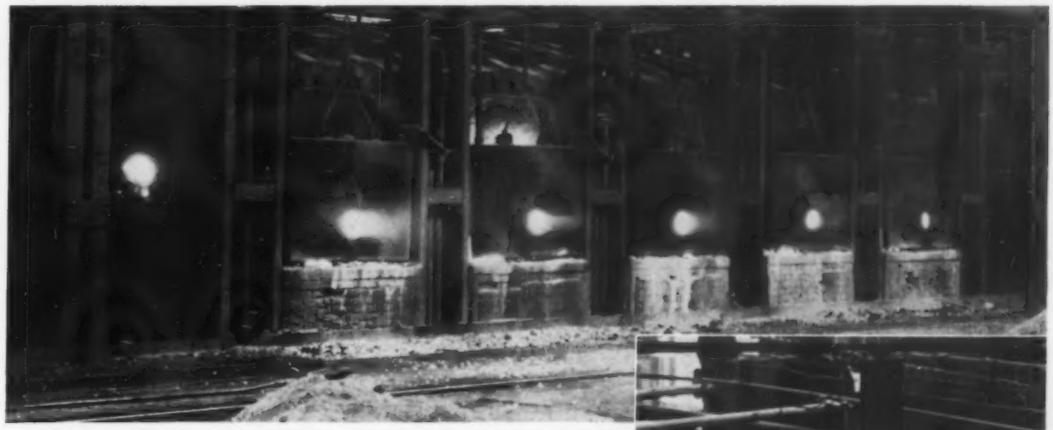
Furnace Pressure Control automatically regulates stack damper position and waste-heat-boiler fan speed. In effect, it controls the flow of outgoing waste gases at a rate corresponding to their formation—regardless of changes in amount of fuel or fluctuating weather conditions. It ties in with combustion control by insuring that all necessary combustion air is supplied through the regenerative system.

Automatic Reversal insures that the reversing operation is started at the correct time, completed in the shortest time, and in a definitely tied-in sequence. It protects refractories from extreme temperature variations, maintains the

Master Control Panel for L & N System of Open Hearth Control in large steel mill. This system gives first helper full control of furnace at all times.

CONTROL SYSTEM

Combustion - Pressure - Reversal - Roof Temperature



Above: One of many Open Hearth Furnaces under L & N Control. Right: L & N Radiation Thermotube used in roof-temperature control. It is mounted on Furnace Roof and connected by leadwires to Micromax Recording Controller (below).

same temperature cycle in the preheated air supplied on the two ends of the furnace, and ties in with the combustion control by insuring the same rate of combustion from each end. It stabilizes both the combustion and furnace pressure controls by keeping them at the last set position until reversal is complete.

Roof Temperature Control guards against dripping or burnout when the furnace is operated at the highest safe limit. As this limit is exceeded a controller automatically reduces fuel supply. Bold-face dial of controller is readable from a distance.

Complete L & N Control is now in use on many open hearths. One steel mill placed the first of their five furnaces under L & N control in October 1931. In October 1932, after one year of operation, they ordered two additional controls. The next repeat order, June 1933, brought the entire battery of open hearths under complete L & N control. Actual operating experience shows that L & N Complete Open Hearth Control increases production and reduces fuel, refractory and repair costs.

LEEDS & NORTHRUP COMPANY
4942 STENTON AVENUE PHILADELPHIA, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS, TELEMETERS, AUTOMATIC CONTROLS AND HEAT-TREATING FURNACES

MATHEWS

For the Steel and Met

Conveyers for the mechanical handling of hot and cold billets, coils, sheets, singly or in stacks, bars and packs, shapes, tubes, molds, castings and machined parts. Ferrous and non-ferrous. » » Useful data on mechanical

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Sept. 24, 25, 26, 1935
Pittsburgh,

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144 Tenth Street

MATHEWS CONVEYER CO., LTD., Port Hope, Ont., Can.

CONVEYERS

al Working Industries

handling devices for these industries is contained in the Mathews catalog. Those concerned can secure a copy by writing any one of Mathews twenty-eight engineering sales offices throughout the United States and Canada or at the

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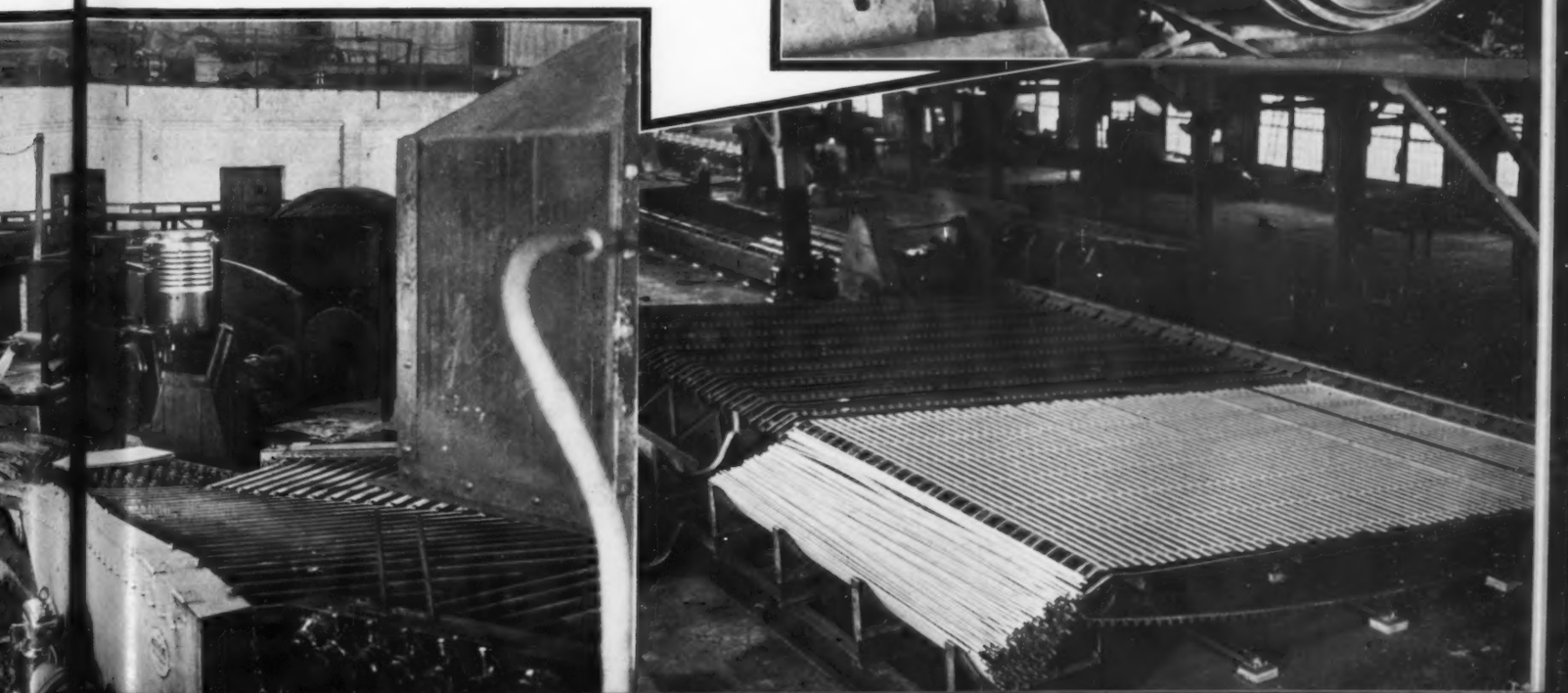
William Penn Hotel
Pennsylvania

EYER COMPANY

Ellwood City, Pa.

MAILLER SEARLES, INC., San Francisco, California



H. A. BRASSERT & CO.

Engineers and Contractors

Designers and Builders

Blast Furnaces and Steel Plants

As Blast Furnace Engineers, we offer, in addition to complete plants, correctly designed equipment for special purposes. This equipment includes the BRASSERT zoned hot blast stove, 90% efficient, and primary and final gas cleaning plants, including the electric precipitator as designed by the RESEARCH CORPORATION. We also offer our recently developed gas valve for hot or cold gas mains, as well as the BRASSERT mud gun, designed for low maintenance cost while stopping the furnace without slackening the blast.

Through our associate, the OPEN HEARTH COMBUSTION COMPANY, we design and build open hearth furnaces, and also offer as special equipment the Venturi Port, the NAISMITH back wall, and other designs for securing the best possible results from any open hearth fuel.

We are specialists and engineers in automatic regulation of fuels and furnaces. Regulation is accomplished by means of the ASKANIA system of control, which is unequalled for accuracy, simplicity and continuity in operation. We install this system in such a way as to make fully available to the heater or helper the knowledge of the superintendent or fuel engineer. We regulate fuel flow, combustion air and furnace pressure, and control furnace atmospheres. This system is applicable to all requirements throughout the plant.

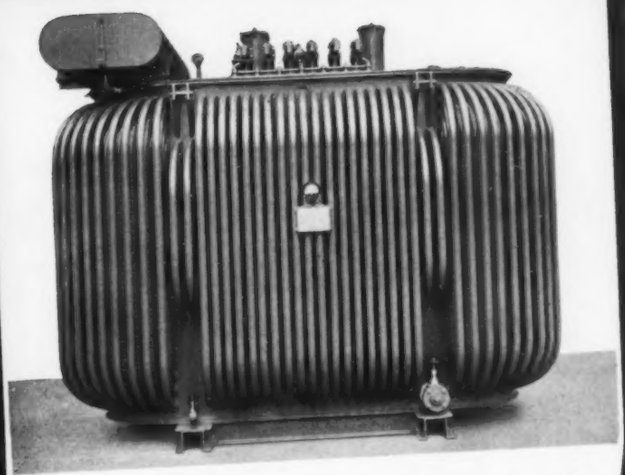
For steel reheating or annealing, we offer the LONG FLAME BURNER, as a means of producing the best possible surface on the steel as rolled. This burner heats by radiation at moderate temperatures. It avoids heavy scaling, and permits control of scale. In combination with ASKANIA regulation, it provides complete means for satisfactory heating.

The BRASSERT Automatic Strainer, while adaptable to all problems of continuous straining, is particularly suitable for mill work. It employs a large number of small replaceable porcelain filter elements. The smallest size opening is 1/64". It is sturdy, will not clog, and is fully continuous in operation.

INFORMATION with regard to any of the above mentioned subjects may be obtained at BOOTH 12 of the Exposition of the IRON & STEEL ELECTRICAL ENGINEERS, September 24, 25, 26—1935.

H. A. BRASSERT & CO. 310 SOUTH MICHIGAN AVE. CHICAGO

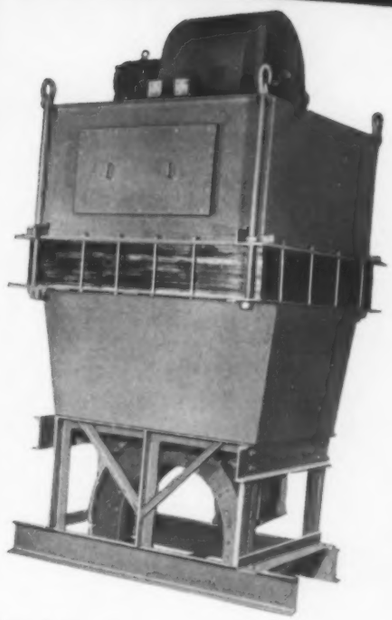
PENNSYLVANIA
TRANSFORMERS
for the HEAVY INDUSTRIES



Scale: $\frac{1}{4}'' = 1'$

2500 kva, 3-phase, 25-cycle power transformers for operating rotary converters.

POWER

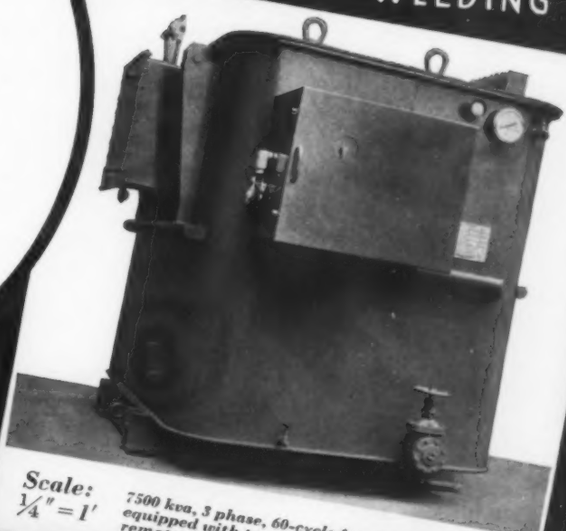


Scale: $\frac{3}{8}'' = 1'$

3700 kva, single-phase, 60-cycle pipe-welding transformer, delivering 200,000 amp.

WELDING

These illustrations serve as typical examples of the ability of this company to solve the most exacting problems of its customers! Because of our vast experience in building transformers, we can render the closest co-operation in meeting the particular requirements of those engaged in the heavy industries.



Scale: $\frac{1}{4}'' = 1'$

7500 kva, 3 phase, 60-cycle furnace transformer equipped with tap changers motor-operated by remote control.

FURNACE

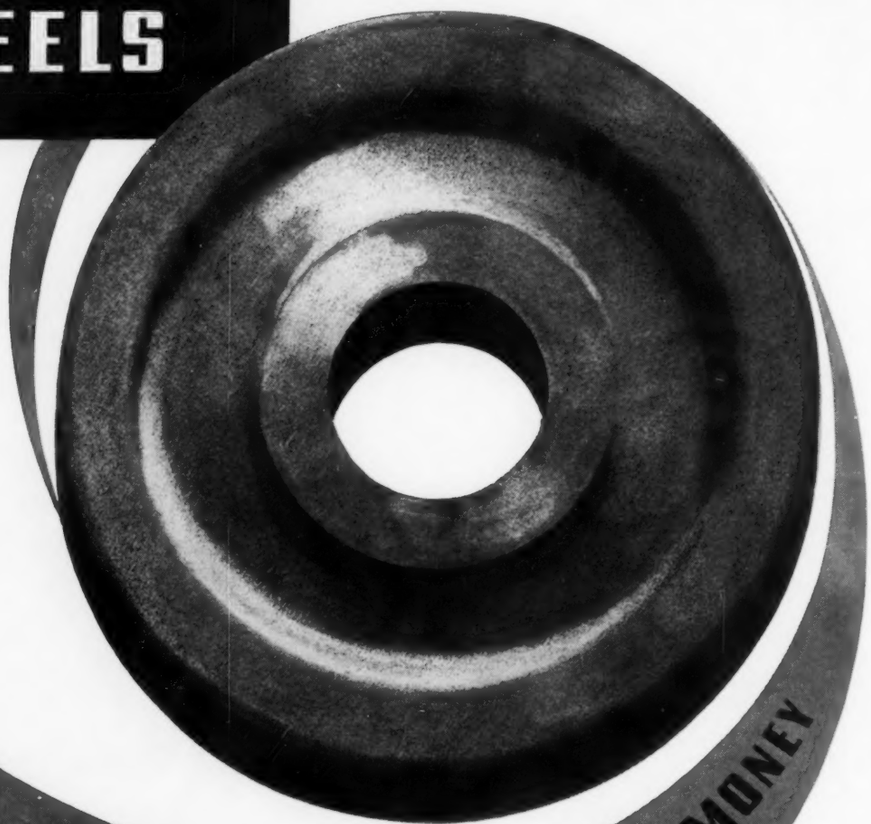
Write for Bulletin 320—just off the press, describing our line of heavy duty transformers.

PENNSYLVANIA TRANSFORMER CO.

1701 Island Avenue N. S., Pittsburgh, Penna.

Carnegie CRANE WHEELS

RIM-TOUGHENED



A LONG RUN FOR YOUR MONEY

"Before you invest, investigate" is the wise counsel of the Better Business Bureau. We suggest that before you invest in crane wheels for replacements or for new equipment, that you investigate the merits of Carnegie Rim-Toughened Wrought Steel Crane Wheels. A special heat-treating process insures long, trouble-free economical service.

335

CARNEGIE STEEL COMPANY • PITTSBURGH

United States Steel Corporation Subsidiary

Standard for
MILL MOTOR COOLING

AMERICAN MULTI-PANEL AUTOMATIC AIR FILTERS are now "Standard Practice" for mill motor cooling in 95% of all steel mills with main drive motors. The MULTI-PANEL filter was designed to meet steel mill requirements and to withstand the demand of steel mill service.

Forced ventilation with clean air supplied through American Air Filters is making possible continuous overloads of as much as 25% without additional cost for the resulting power increases.

Wherever AMERICAN MULTI-PANEL AIR FILTERS have been installed an immediate saving has resulted through the elimination of costly shut-downs for repairs, lowered upkeep costs and increased operating efficiency.

Hundreds of additional installations have been made in steel mills and industrial plants whose original equipment was purchased as far back as 1928.

Let us send you "American Air Filters in Industry," a booklet that gives detailed information on actual savings that AMERICAN MULTI-PANEL AIR FILTERS have effected for the largest companies in the iron and steel industries.

Visit the American Air Filter Exhibit
Space 52-53
at the Iron & Steel Exposition
Sept. 24-26

AMERICAN AIR FILTER COMPANY

In Canada—Darling Brothers, Limited—Montreal, P. Q.

72 Central Avenue — Louisville, Kentucky

AMERICAN AIR FILTERS

BANTAM

CONICAL ROLLER THRUST BEARINGS FOR BOULDER DAM CYLINDER GATE HOISTS

36 of these Bantam Conical Roller Thrust Bearings were installed in the intake tower cylinder gate hoists at Boulder Dam.

The selection of Bantam Conical Roller Thrust Bearings for this important installation by the general contractor, the Consolidated Steel Company of Los Angeles was based on the outstanding performance record of Bantam Bearings on heavy duty production equipment.

In addition to the Conical Roller Thrust Bearings for the cylinder gate hoists, Bantam also supplied the large special Roller Thrust Bearings for the crane hook blocks on the Harnischfeger cranes used at Boulder Dam.

Bantam Quill Roller Bearings are also installed in the World's largest circuit breaker employed in connection with the Power Plant control system at Boulder Dam.

The unparalleled service which Bantam renders on bearing design and manufacture is ably demonstrated at Boulder Dam.

These bearings are 14" ID x 24½" OD x 4 9/16" thick and have a thrust capacity of 1,000,000 pounds at operating speed.

Take your Toughest Bearing job to Bantam

Trade Mark Reg. U.S. Pat. Off.

Send for new general catalog on Ball and Roller Bearings.

THE BANTAM BALL BEARING CO.

SOUTH BEND, INDIANA

CHICAGO · PHILADELPHIA · YOUNGSTOWN · PITTSBURGH · DETROIT · ROCHESTER, N. Y. · DALLAS · SEATTLE · NEW YORK · TOLEDO · NEW ORLEANS · WASHINGTON, D.C.

BBB

ONE OR A HUNDRED MILLION • 1/32" TO 60"

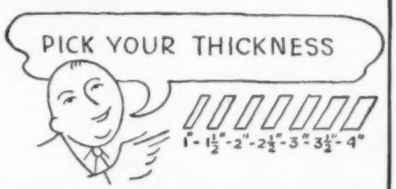
REASON No. 1

Made of especially selected and calcined diatomaceous silica, blended and bonded with asbestos fibre, Superex has unusual heat resistance. For many years, it has proved its dependability under severe service behind refractory linings in high-temperature furnaces.

REASON No. 2

Its remarkably low thermal conductivity means that, for the same insulating value, a lesser thickness of Superex is required than any material of equivalent heat resistance.

REASON No. 3



Superex is furnished not only in the thicknesses shown above, but also in any intermediate thickness desired. No waste; you buy only the thickness you need.

5 Reasons Why

J-M SUPEREX BLOCKS behind your Refractory Linings

FOR MANY YEARS, in many thousands of installations, Superex has proved itself the superior block insulation for high-temperature industrial equipment. Recently, it has been made even more efficient, even more resistant to high temperatures than ever before.

Here, briefly, are five important reasons why Superex, used behind refractory or semi-refractory linings, will give you trouble-free service and maximum efficiency and economy.

REASON No. 4

Blocks are large (up to 12" x 36"); they are light (23 lb. per cu. ft.). Superex goes on quickly, economically—as much as 3 sq. ft. at a time—with marked savings in labor cost.

REASON No. 5

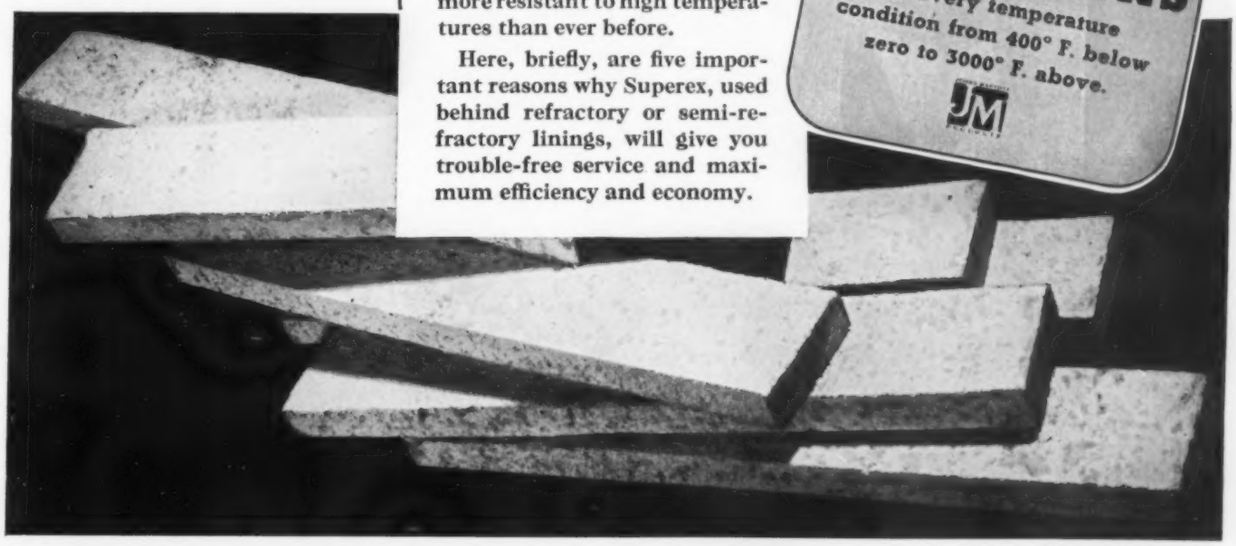
No matter what insulation you use, or how carefully you apply it, there's bound to be heat leakage through joints. Heat passes through joints like water through a sieve.

But with Superex Blocks, because of the large-size units, such losses are reduced to a negligible degree.

Johns-Manville INDUSTRIAL INSULATIONS

For every temperature condition from 400° F. below zero to 3000° F. above.

JM



A Few Uses for Superex

You will find Superex Blocks especially well adapted for the insulation of slab heating, annealing and all types of controlled atmosphere furnaces, producer gas mains, hot-blast stoves, open hearths and regenerators, and boiler furnaces.

Superex is also available in the form of pipe insulation for superheated steam and hot oil and gas lines.

Free Data Sheets on Superex Blocks, Sil-O-Cel Brick and other Johns-Manville insulations for high-temperature furnaces mailed on receipt of coupon.

JOHNS-MANVILLE,
22 East 40th Street, New York City

Send me data sheets on Insulation of Industrial Furnaces and Ovens, including information on Superex Blocks.

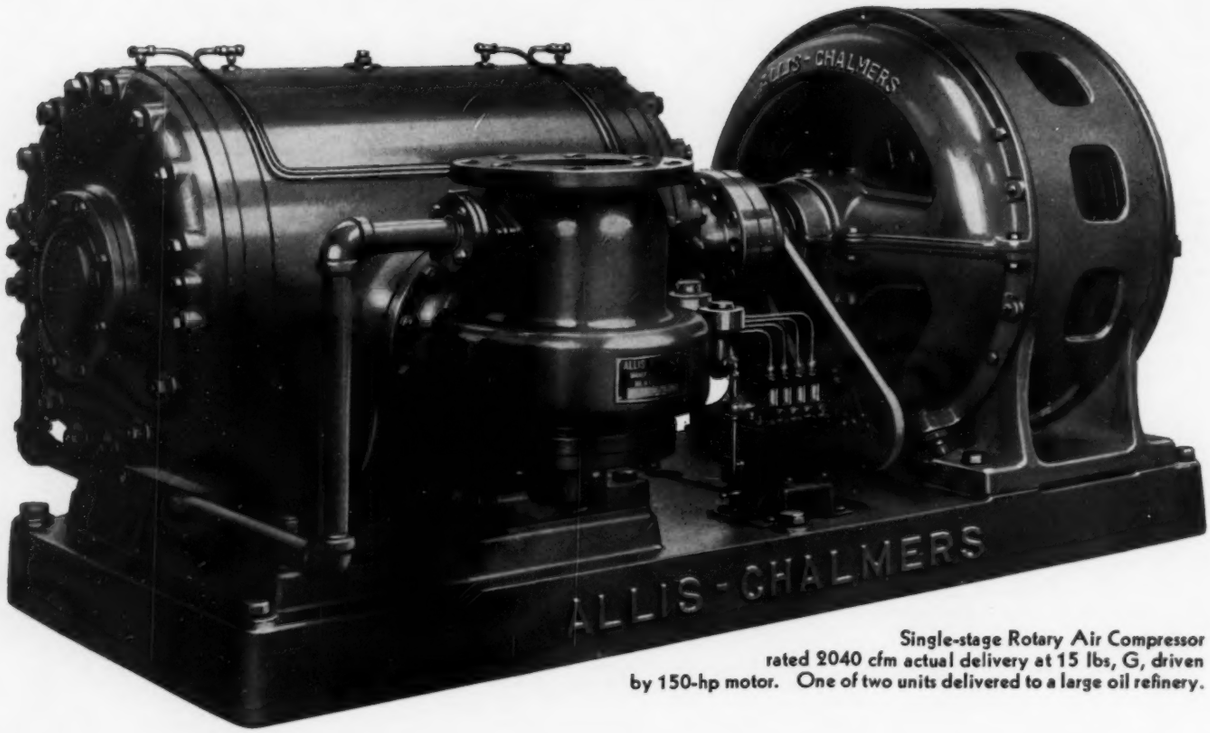
Name_____ Title_____

Firm Name_____

Address_____

City_____ State_____

IS-9-35



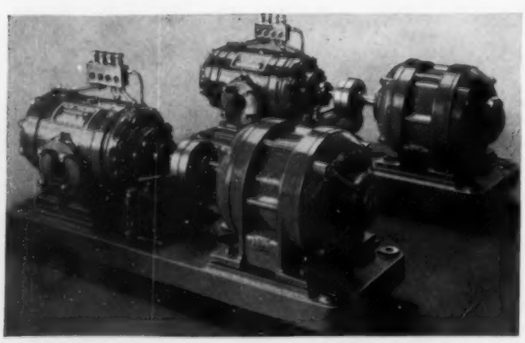
Single-stage Rotary Air Compressor rated 2040 cfm actual delivery at 15 lbs, G, driven by 150-hp motor. One of two units delivered to a large oil refinery.

Steady, Smooth Delivery *from Rotary Motion . . . . .*

ALLIS-CHALMERS Rotary Air Compressors have no reciprocating parts. The design is simplicity itself—merely a cylindrical rotor arranged eccentrically in a cylindrical casing, and sliding vanes, fitted into slots cut in the rotor, which move in and out as the rotor is turned. "Floating Rings" restrain the blades from touching the casing, and, turning with the rotor and blades, reduce friction and wear to a minimum.

The simplicity of the design and the principle of operation, besides reducing maintenance to a negligible factor, enable valuable floor space to be conserved and combine smooth, vibrationless operation with steady flow of air delivery.

When used as dry vacuum pumps, exceptionally high economies can be obtained.



Two Rotary Dry Vacuum Pumps, each rated 104 cfm, actual delivery, at 28" vacuum, driven by 7½-hp motors, for operating bottle-making machinery.

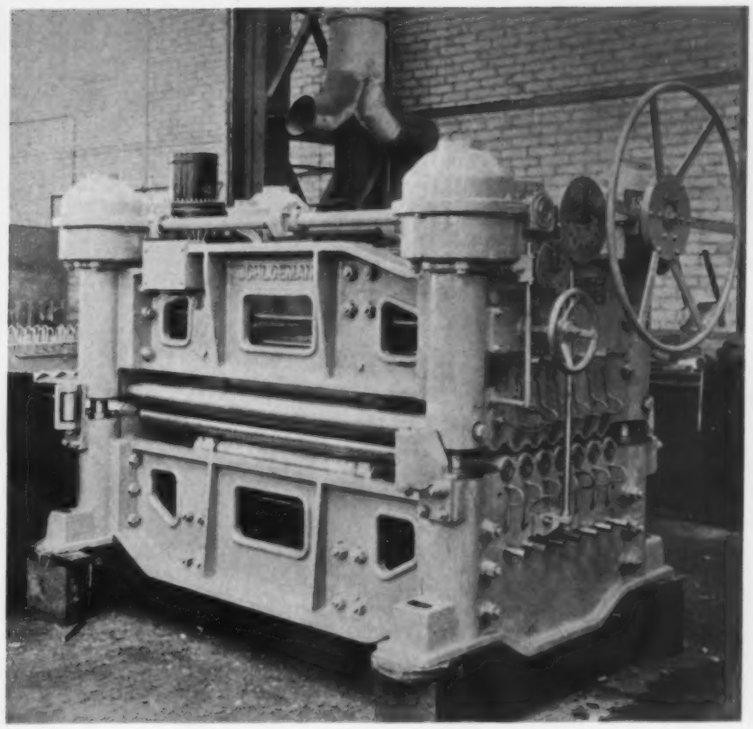
Standard Single-stage Compressors and Vacuum Pumps are built in capacities from about 50 cfm to 2000 cfm, for pressures up to 60 lbs, G, and vacuums up to 28½" Hg (referred to 30" barometer)

Two-stage Units are built for the same volumes for pressures up to 150 lbs, G, and vacuums up to 29.85" Hg.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

SCHLOEMANN



ROLLER LEVELER

With backed-up rollers. Built for hot and cold material in all commercial widths. All features to insure flat material are incorporated.

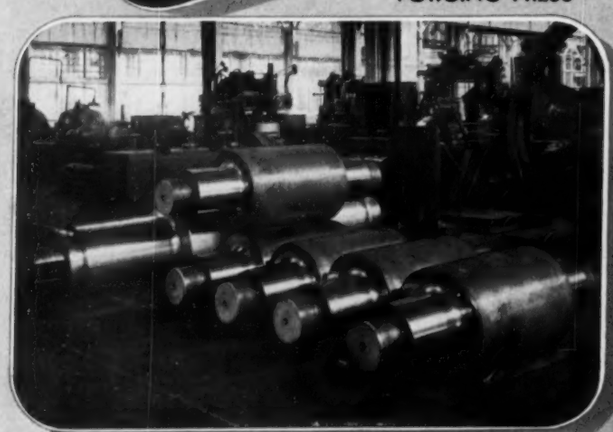
SCHLOEMANN

ENGINEERING CO. PITTSBURGH, PA.
Rolling Mill Machinery Hydraulic Presses

MESTA Steel

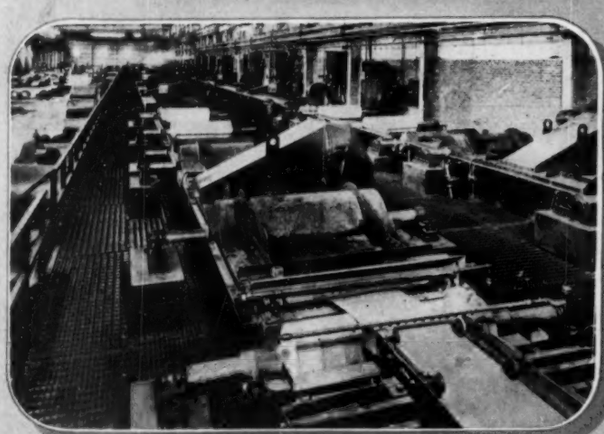
MESTA
FORGING PRESS

FOUR HIGH HOT MILLS
BLOOMING MILLS
ROLLS
ROTARY FLYING SHEARS
PICKLING EQUIPMENT
FORGINGS

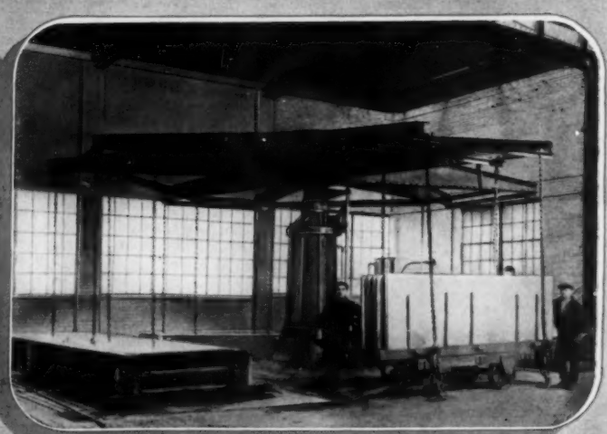


GROUP OF MESTA ROLLS

GROUP OF MESTA FORGINGS



MESTA WIDE CONTINUOUS PICKLING UNIT

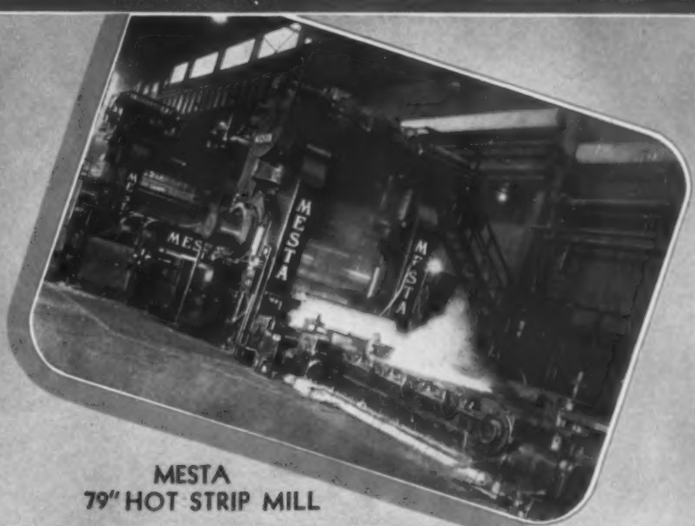


MESTA PATENTED PICKLING MACHINE

MESTA MACHINE COMPANY

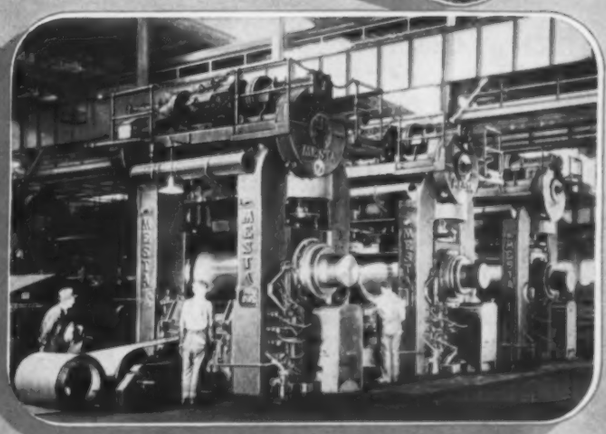
Mill Equipment

FOUR HIGH COLD MILLS
SLABBING MILLS
ROLL GRINDERS
TRIMMERS & SLITTERS
CLEANING EQUIPMENT
CASTINGS



MESTA
79" HOT STRIP MILL

MESTA 40" BLOOMING MILL



MESTA 54" COLD STRIP MILL

MESTA 79" HOT STRIP MILL

MESTA ROTARY FLYING SHEAR

PITTSBURGH, PA.

GREDAG
REG U. S. PAT OFF

ROLL NECK LUBRICANTS

S43D

. . *for* **PRESSURE SYSTEM ROLL NECK LUBRICATION**

R2 - R3 - R4 - R7B - R9H

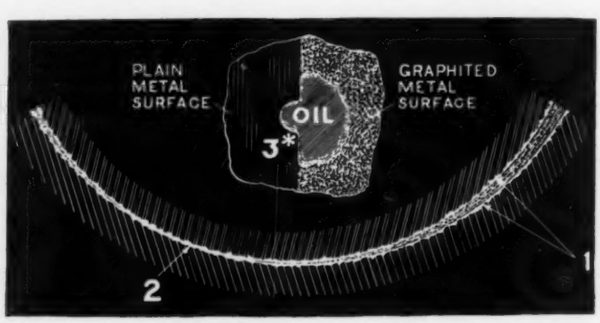
. . *for* **OPEN WINDOW BEARINGS** . . . . .

● ● ●

Gredag Roll Neck Lubricants are Free from Fillers of any kind. They are insoluble in water. They possess the following unique advantages:

1 They develop highly polished bearing surfaces, with PURE Acheson electric furnace graphite equalizing the microscopic irregularities of the metal surfaces.

2 These graphitic surfaces carry the bearing load, prevent destructive metal-to-metal contact and afford low starting friction should the grease film break during prolonged periods of rest.

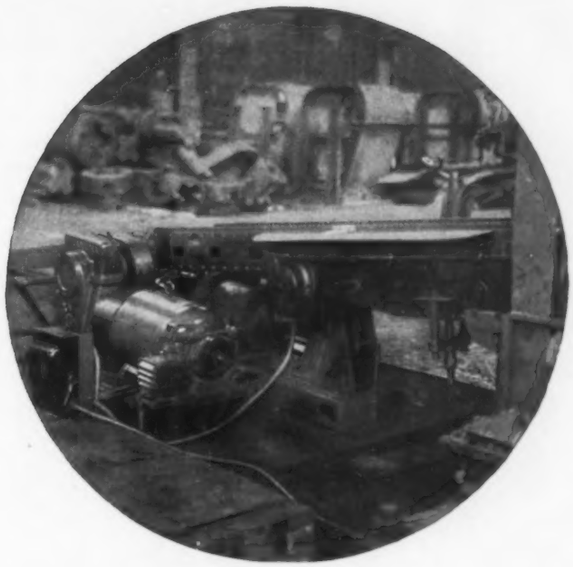


*Try this simple experiment on a smooth metal surface with a lead pencil and a drop of oil. It demonstrates the reason for the superiority of Gredag Lubrication.

3 The remarkable affinity of Acheson graphite for grease and oil—7 to 10 times that of plain metal—establishes a firmly adhering film of grease lubrication on every element of the bearing surfaces with the first revolution. This film resists pressure, heat and water. It withstands slow speeds and heavy shocks. It prevents rust on water-cooled bearings.

Gredag is the most efficient lubricant for the exacting demands of Steel Mill Equipment.
IT INSURES LUBRICATION

NATIONAL CARBON COMPANY, INC.
CARBON SALES DIVISION . CLEVELAND, OHIO
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices: New York Pittsburgh Chicago San Francisco



Servants of the Steel Industry

WAGNER MOTORS

Dependable motors are one of the important cogs in the wheels of industry. A breakdown causes unnecessary expense and production losses.

Wagner motors are built to meet the severe operating conditions encountered in the steel industry. That's why many steel companies and large firms guard against costly shutdowns by specifying Wagner motors.

Wagner motors are built in a wide variety of types; from 1/250 hp to 400 hp; in either open, explosion-proof, or totally-enclosed. In the illustration above is shown a totally-enclosed fan-cooled type CP motor driving a catcher table in a steel mill. It reverses some 30 times per minute. Wagner type CP motor was selected because the surrounding atmosphere is unspeakably dusty;—because no steel-dust or grit can injure Wagner type CP motors.

Call on Wagner! Their experience in applying general and special-purpose motors in the steel industry will be very helpful in your next motor installation.

Visit Wagner's Booth No. 16 at Iron and Steel Exposition, William Penn Hotel, Pittsburg, Pa., on September 24, 25, and 26.

L235-4

● Wagner type RP open-frame squirrel-cage motor with cartridge-type ball-bearings;—available in seven types of electrical characteristics.

● Wagner type CP totally-enclosed fan-cooled ball-bearing motor—the answer to dust, fume and moisture problems.

Wagner Electric Corporation

Industrial Division

4900 Baum Blvd. Pittsburg, Pa.

RECLAIMED!

. . . at a fraction of replacement cost

Here's the sort of job on which Thermit welding really shows its stuff.

This heavy plate mill housing . . . 22 ft. high and weighing 82 tons . . . fractured in two places. To replace it would have meant not only the expense of a complicated new casting, but also weeks of delay with production held up and overhead steadily mounting.

But the frame was Thermit welded and back in service in little more than a week . . . permanently repaired at a small fraction of replacement cost.

Savings such as this, ranging from 50% to 85%, are typical of Thermit welding for the reclamation of housings, crank shafts, connecting rods, charging peels, manipulator racks, pinion teeth, wabblers, and other parts.

The applications of Thermit welding are innumerable. Let us send you the pamphlet "Thermit Welding—Industry's Master Maintenance Tool," containing details of methods and other information.

THERMIT WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.

ALBANY • PITTSBURGH • CHICAGO • SOUTH SAN FRANCISCO • TORONTO

No Scoring

●

Longer Brake Life

●

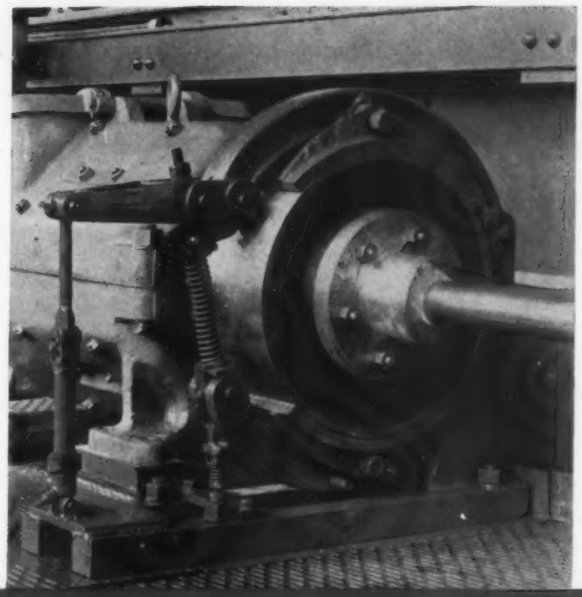
Pre-formed Lining

●

Lower Maintenance

●

The illustration to the right shows a close-up view of the hydraulic brake and brake shoes used on the bridge motor of a 15-ton double-hook crane installed in a large steel plant. The brake shoes are lined with CoMaX lining.



Servants of the Steel Industry

Wagner "CoMaX" Brake Lining

Wagner CoMaX brake lining is pre-formed in blocks to fit all types and makes of industrial brakes. The blocks save installation time and reduce inventory.

Wagner CoMaX is non-abrasive — hence, wherever installed, scoring of brake wheels is a matter of the past. Wagner CoMaX is exceptionally long-lived — cuts down maintenance, lowers overhead, lessens shutdowns for replacement of brake-wheels and brake lining.

Each CoMaX block is ground on both sides, assuring perfect over-all contact between lining and brake wheel. The blocks are wire-backed, permitting deep seating of rivets and increasing the depth of lining available for braking service.

For complete information regarding non-scoring, long-lived Wagner CoMaX industrial-brake blocks, write to Industrial Division, Wagner Electric Corporation, 4900 Baum Boulevard, Pittsburg, Pa., where a complete stock of blocks are warehoused for immediate shipment.

Visit Wagner's Booth No. 16 at Iron and Steel Exposition, Wm. Penn Hotel, Pittsburg, Pa., on September 24, 25, and 26.

B335-2

● Wagner CoMaX industrial-brake blocks are available in every form and dimension used in the steel industry —to fit every type and make of industrial brake. Above photo shows Wagner CoMaX industrial lining mounted on brake shoe. Especially note the thickness of the lining and the depth of the rivet holes — assuring longer lining life and lower maintenance.

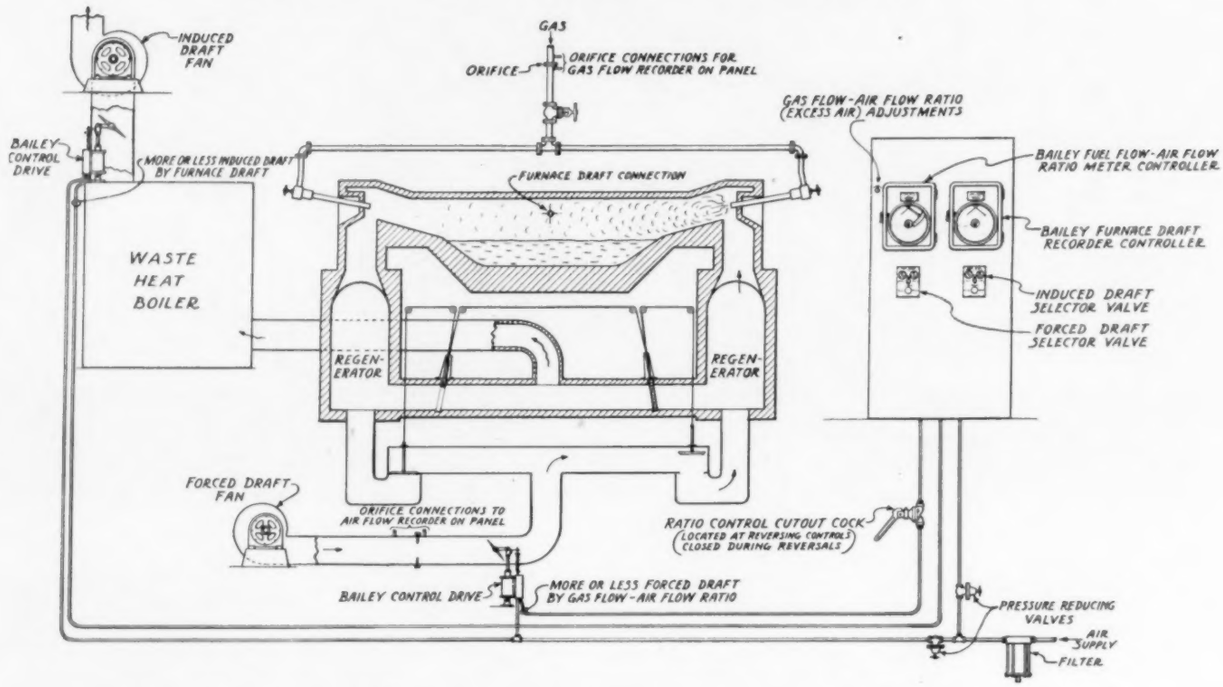
● Note the deep-seated rivet in this cut-away section. Wagner CoMaX can be counterbored down to the strong wire backing, to seat the rivets directly on the wire. Thus the amount of lining available for braking service is considerably increased, permitting longer service for equal lining thickness than that available with other types of lining. For example, in a Wagner CoMaX block ½-inch in thickness, the rivets can be seated to within ⅛-inch of the back — allowing ⅛-inch for wear before the rivet-heads touch the brake-wheel. In other words, as much as 87½% of the material in ½-inch lining is available for braking service.

Wagner Electric Corporation

Industrial Division

4900 Baum Blvd. Pittsburg, Pa.

SHORTEN HEATS •
LENGTHEN CAMPAIGNS •
LOWER FUEL CONSUMPTION •


INDUCED DRAFT FAN
GAS
ORIFICE
ORIFICE CONNECTIONS FOR GAS FLOW RECORDER ON PANEL
GAS FLOW-AIR FLOW RATIO (EXCESS AIR) ADJUSTMENTS
BAILEY CONTROL DRIVE
MORE OR LESS INDUCED DRAFT BY FURNACE DRAFT
FURNACE DRAFT CONNECTION
BAILEY FUEL FLOW-AIR FLOW RATIO METER CONTROLLER
BAILEY FURNACE DRAFT RECORDER CONTROLLER
WASTE HEAT BOILER
INDUCED DRAFT SELECTOR VALVE
FORCED DRAFT SELECTOR VALVE
REGEN-ERATOR
REGEN-ERATOR
FORCED DRAFT FAN
ORIFICE CONNECTIONS TO AIR FLOW RECORDER ON PANEL
RATIO CONTROL CUTOUT COCK (LOCATED AT REVERSING CONTROLS CLOSED DURING REVERSALS)
BAILEY CONTROL DRIVE
MORE OR LESS FORCED DRAFT BY GAS FLOW-AIR FLOW RATIO
PRESSURE REDUCING VALVES
AIR SUPPLY
FILTER

• with Bailey Meter Control

FOR OPEN HEARTH FURNACES

Open hearth furnaces provide a greater return on the investment when equipped with Bailey Meter Control. This new air-operated control system automatically maintains constant Furnace Pressure and the most economical Fuel—Air Ratio consistent with furnace life.

Peak flame temperature is assured by the installation of Bailey Meter Control, as the result of correct excess air for combustion and reduction of cold air infiltration to a minimum. Rapid deterioration of refractories is prevented, prolonging the length of campaigns. The number of B. t. u. required per ton of steel is lowered.

Details on how Bailey Meter Control can shorten heats, lengthen campaigns, and lower fuel consumption of your open hearth furnaces, will be gladly furnished upon request.

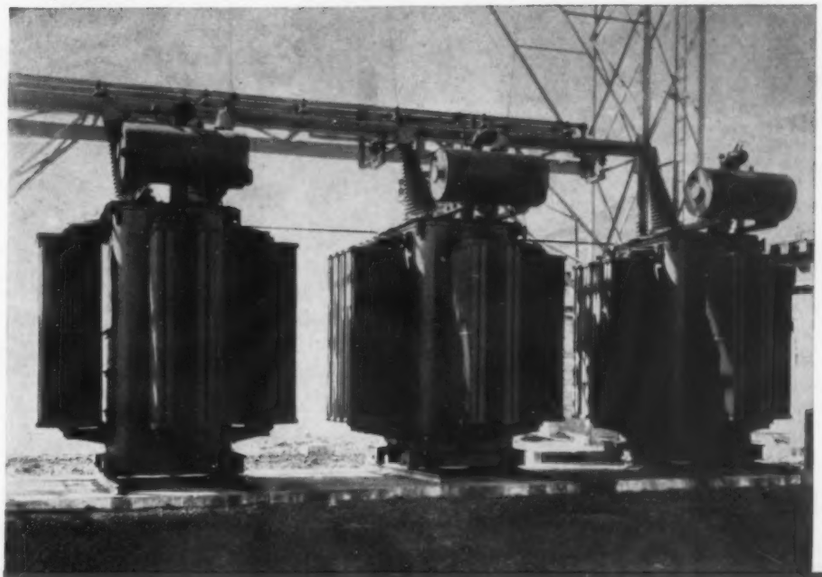
BAILEY METER CONTROL SYSTEM

The flexibility of Bailey Meter Control makes it readily adaptable to many furnaces other than the open hearth. If you are interested in billet heating, welding or other metallurgical furnace, let us describe the method of application and benefits of Bailey Meter Control.

A-9

BAILEY METER COMPANY
1047 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

BAILEY METER CONTROL



Servants of the Steel Industry

WAGNER TRANSFORMERS

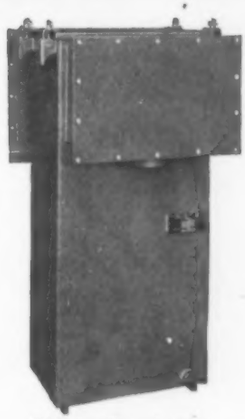
Wagner power and distribution transformers, like faithful servants, have a record of dependable and efficient service to the steel industry, extending over a long period of years. Forty-four years of valuable experience in developing and manufacturing transformers form the background for each Wagner transformer.

Wagner transformers are of sturdy construction and are liberally designed to withstand abuses and to operate at all times at high efficiency. They meet the demands for reliable service under all conditions.

The Wagner line of transformers includes all types and sizes of power and distribution transformers, enabling Wagner to supply all your transformer requirements. The above illustration shows three single-phase 4000-kva, 60-cycle, 69000 to 2400 volt transformers installed in the plant of a large steel company. These transformers were installed in a location where metallic dust is prevalent in sufficient quantity to cause normal-rating bushings to flashover. Transformers as large as these naturally cannot be enclosed in dust-tight chambers — therefore, higher-rating bushings are used to increase the creepage distance between tank and terminal. On the above transformers, 115-kv high-voltage oil-filled bushings are used with 69-kv coordinating gaps. This is just one of the many details considered by Wagner engineers in supplying transformers that give uninterrupted and trouble-free service.

Visit Wagner's Booth No. 16 at Iron and Steel Exposition, Wm. Penn Hotel, Pittsburg, Pa., on September 24, 25, and 26.

T435-2



Lighting Transformers

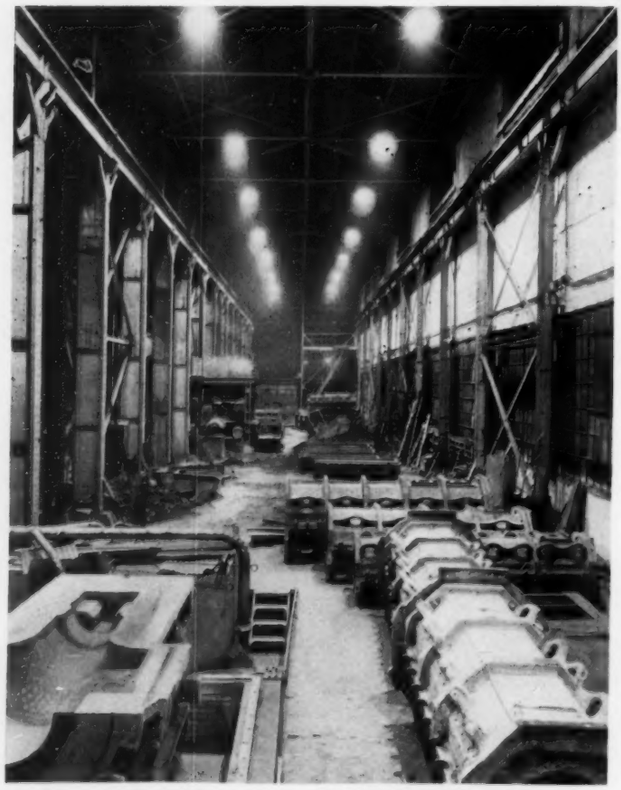
Auxiliary Power Transformers

Wagner Electric Corporation
Industrial Division
4900 Baum Blvd. Pittsburg, Pa.

Quality **WORK** *is mostly* **SEEING . . .**

A MAN'S work depends upon his vision. It matters not whether he works with delicate instruments where a miss of 1/1000 of an inch is literally as bad as a mile, or making molds for 10 ton rolls. In either case inaccurate seeing spells instant rejection.

Like good tools and efficient machinery, adequate lighting insures quality workmanship. Through years of study definite lighting standards have been established for practically every type of a seeing task. These standards not only embrace actual lighting intensity, but also such important factors as glare and proper distribution of light.



Molding Floor of the Pittsburgh Rolls Corporation

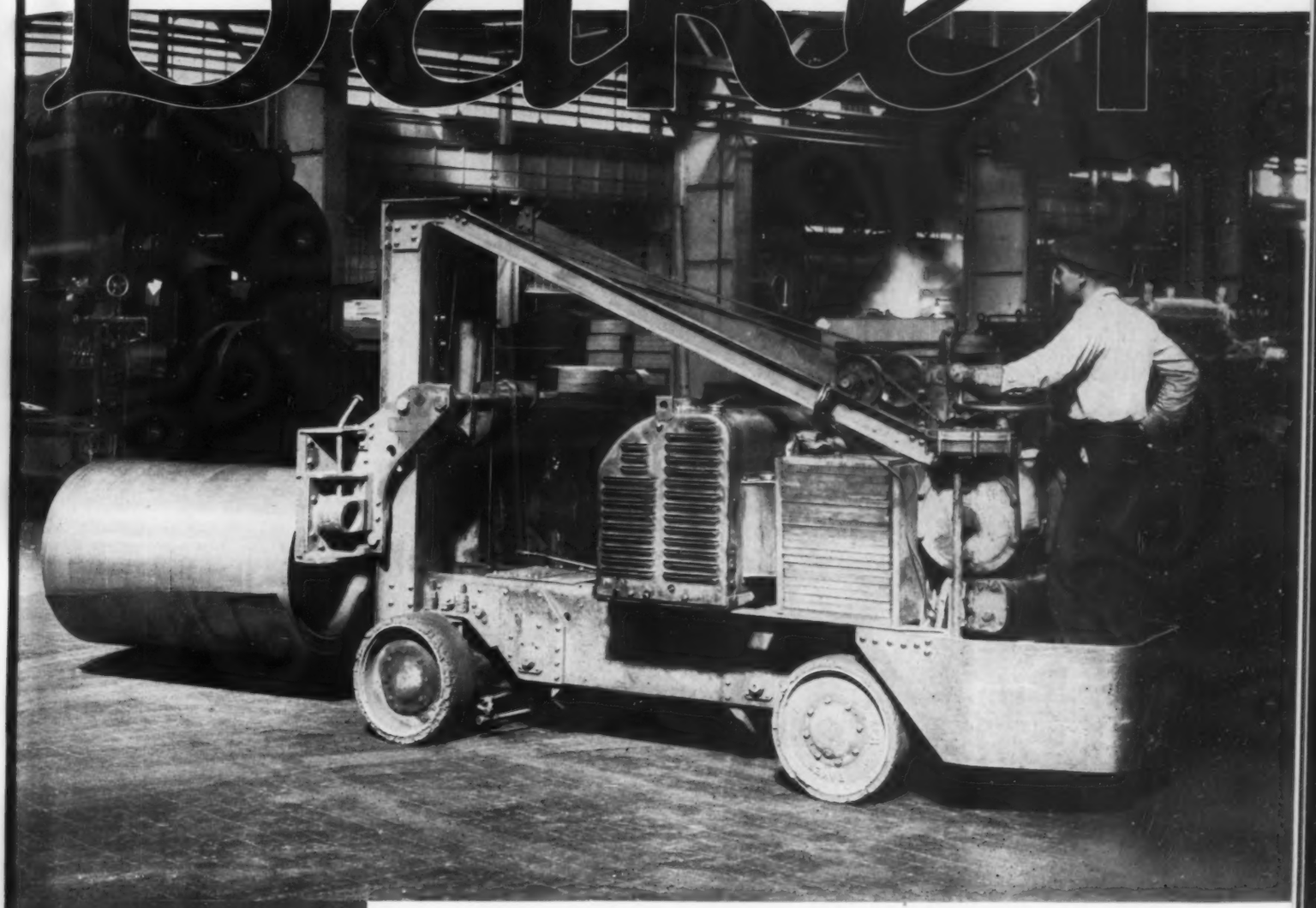
Our engineers are equipped with this information and will be pleased to analyze your lighting requirements. With light measuring devices and demonstration equipment they are able to advise you whether workers are on an equal basis as to seeing conditions, whether errors and spoilage can be reduced, wasted space utilized, etc. This service is free to all our customers.

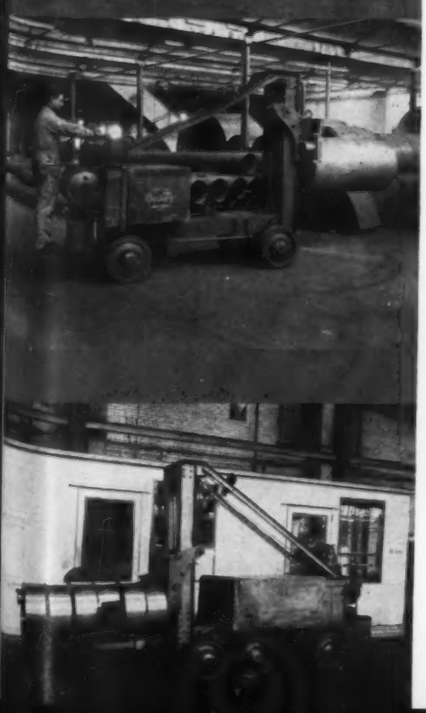
DUQUESNE LIGHT COMPANY

PIONEERS IN PUBLIC SERVICE

GRant 4300 . . . LINE 283

Baker





Baker Rams are made in capacities from 4,000 pounds up. The lower photo at the left shows a 10,000 pound capacity ram with tire-saving, easy steering compensating 4 wheel tandem axles under the load.

SPEED • STAMINA • SAFETY • ECONOMY

● The illustration above shows one of ten similar BAKER rams in *one* mill which handle coiled strip from the hot mill to storage, to skin rolls, to cold mill, to cutters, and to shipping department. Not only is this work handled more quickly, more safely, and more economically than before but the complete freedom of travel of the trucks gives them a versatility of service which is invaluable in the occasional emergency. ◆ The Baker ram is but one of many types of BAKER Trucks and Tractors and Cranes designed and built especially for the particularly severe requirements of steel mill service. For detailed information write

BAKER INDUSTRIAL TRUCK DIVISION
of THE BAKER-RAULANG COMPANY
2166 WEST 25TH STREET • • CLEVELAND, OHIO

The G-E Asbestos Path to Efficient Operation

THERE is no allowance for error in the Steel Industry. That is why your judgement must always be right — the first time. Profits and production depend upon the wise choice of material and equipment.

When you are specifying Wires and Cables, wisdom points to Deltabeston. Places in your plant where equipment is most subject to stress and strain can be wired safely with this superior asbestos-covered cable and wire.

DELTABESTON is made to resist deterioration. It is built to solve problems — in situations that would ruin ordinary wire and cable insulation.

DELTABESTON is designed, engineered and built to protect the steel industry from unnecessary losses. Accept the judgement of successful operators by using Deltabeston.

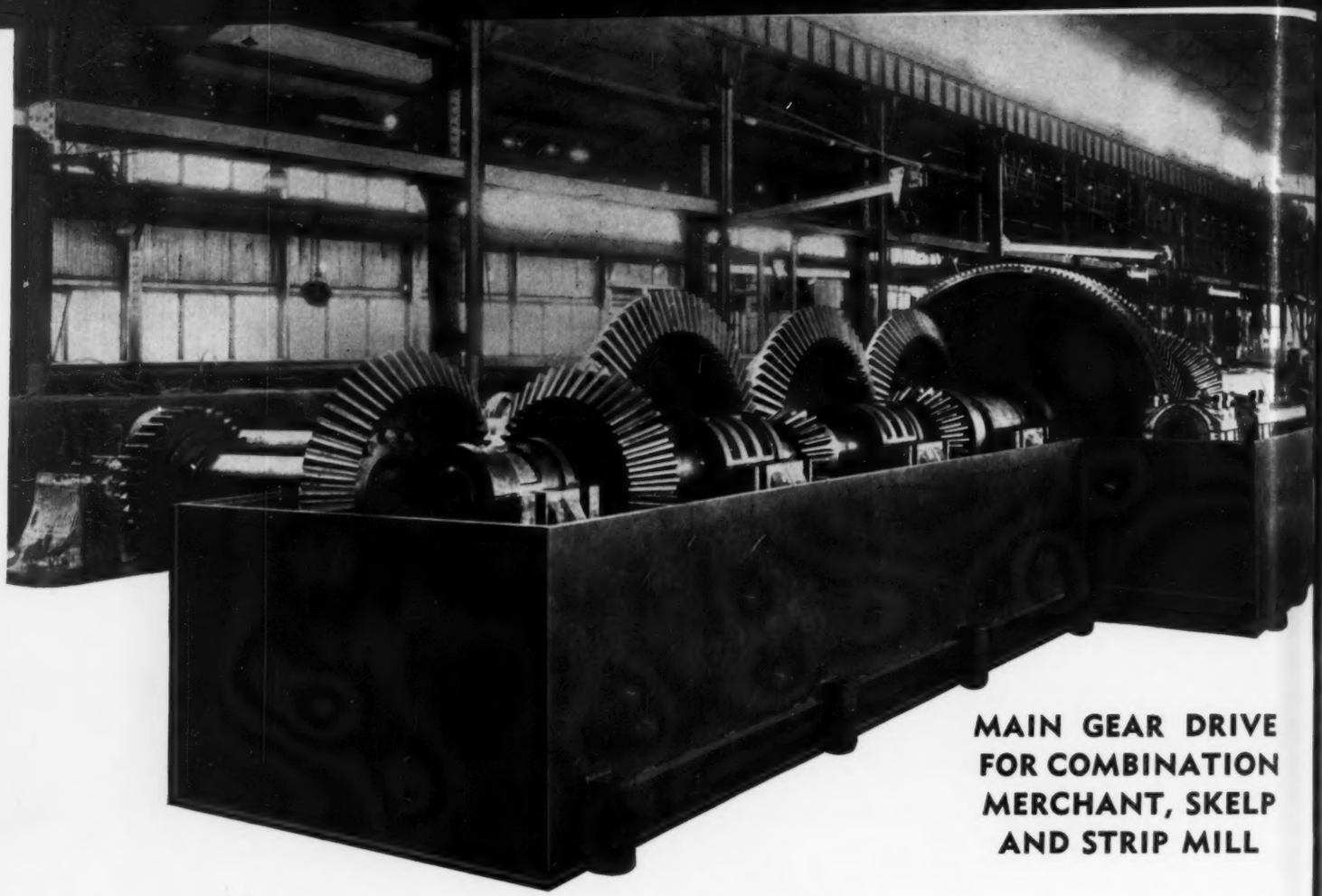
There is a **DELTABESTON** Asbestos Insulated Conductor for every kind of steel mill operation. Power Cable . . . Motor Lead Cable . . . Control Cable . . . Switchboard Wire . . . Rheostat Wire . . . Magnet Wire — all offer this protection against failure at vulnerable spots.

Try **DELTABESTON.** Performance will prove that it is superior. Complete information and samples will be sent to you promptly. Write Section Y-299, General Electric Co., Bridgeport, Conn. Distributed by General Electric Merchandise Distributors and Graybar Electric Co.

GENERAL ELECTRIC

DELTABESTON WIRE AND CABLE

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT



MAIN GEAR DRIVE
FOR COMBINATION
MERCHANT, SKELP
AND STRIP MILL

As Designing Engineers and Manufacturers we are pleased to offer our facilities in connection with

MORGAN CONTINUOUS AND SEMI CONTINUOUS MILLS

for production of

Wire Rod -- Merchant Bar -- Sheet Bar -- Billets
Skelp and Strip

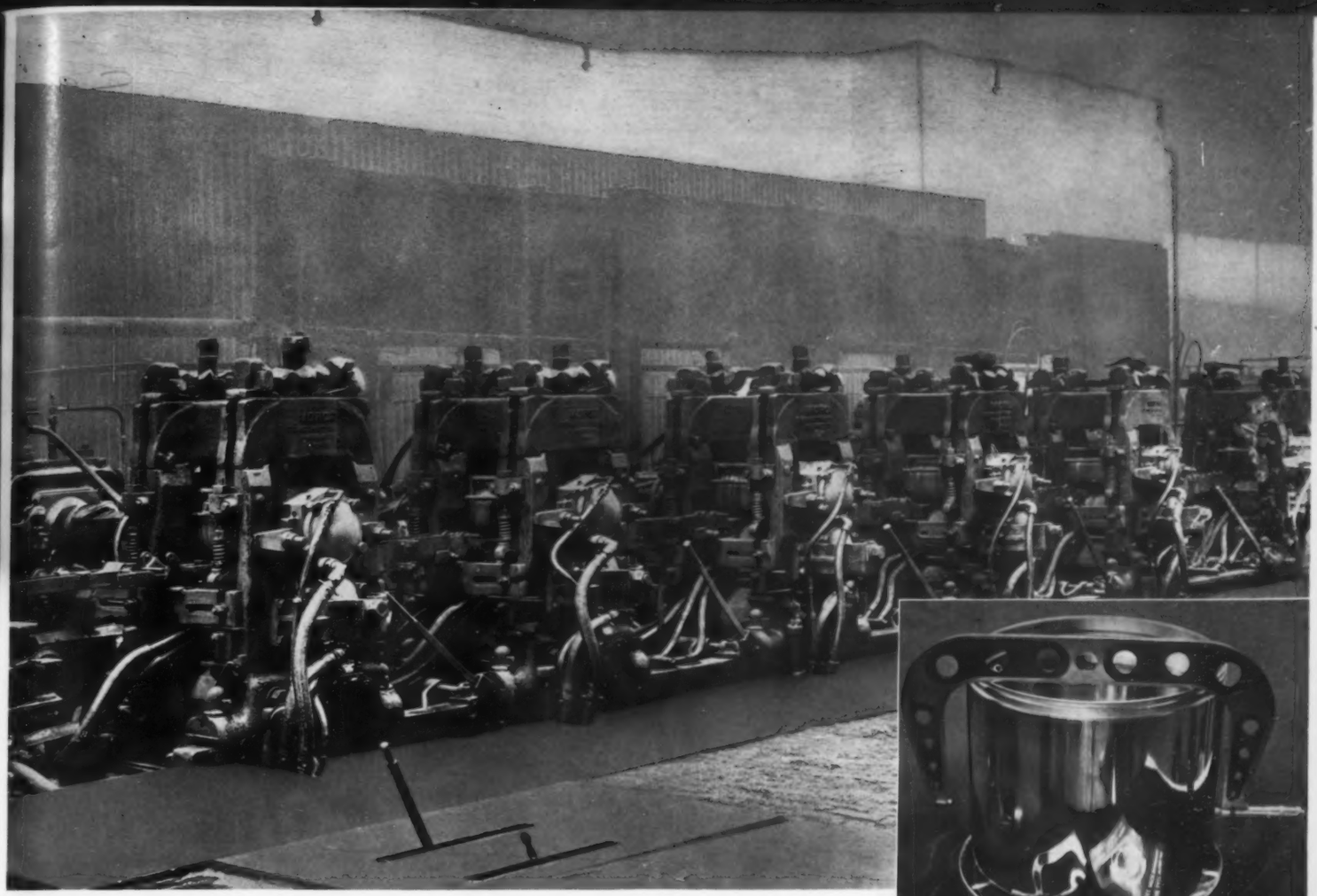
also

Wire Drawing Machinery and Accessories
Producer Gas Machines
Furnace Controls

MORGAN CONSTRUCTION COMPANY

Worcester, Mass., U. S. A.

Pittsburgh Office, 1602 Koppers Building



FINISHING TRAIN OF 12 INCH STRIP MILL

Both the Roughing and Finishing Stands of the Above Mill are Equipped Throughout with

MORGOIL BEARINGS

Hundreds of these Bearings
are in Operation
On All Sizes and Types of
Hot and Cold Mills
Both Here and Abroad

MORGOILS OFFER:
Utmost Precision
Highest Possible Finish
Maximum Power Saving
Greatest Capacity
Longest Life – Lowest Upkeep

MORGAN CONSTRUCTION COMPANY

Worcester, Mass., U. S. A.

Pittsburgh Office, 1602 Koppers Building

SEE

DIXON EXHIBIT

BOOTH No. 60

IRON AND STEEL EXPOSITION

DIXON'S GRAPHITE ROLL NECK GREASES

have reduced power consumption from 10% to 25% with no cost for special equipment. We have proved this in many Mills. Ask at Dixon Booth for copy of Test Report.

NEW PRODUCTS

DIXON'S GRAPHITE COATING

This material protects roll necks and finished surfaces from corrosion while in storage. Also serves as a lubricant when rolls are replaced in service.

DIXON'S MICRON-IZED GRAPHITE

The finest Graphite (smallest particle size) Ever Produced.

DIXON'S GRAPH-AIR GUN AND MICROFYNE GRAPHITE

There are many Dixon Graphite Products for the Metal Industry

Cup Greases — Gear Lubricants

Swabbing Compounds — Lubricating Rods

Motor and Generator Brushes

Also many special graphite lubricants and all grades of graphite

TICONDEROGA LUBRICATING FLAKE GRAPHITE

THE STANDARD OF COMPARISON FOR OVER 50 YEARS

JOSEPH DIXON CRUCIBLE CO.

JERSEY CITY — GRAPHITE EXCELLENCE SINCE 1827 — NEW JERSEY

CLARK

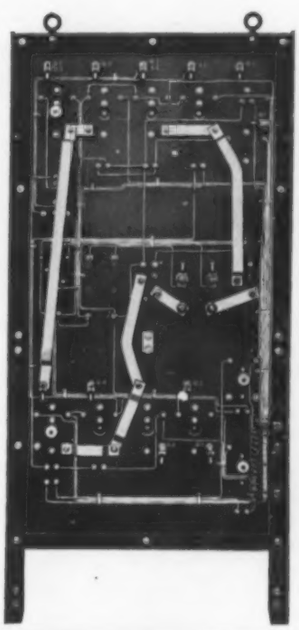
AUTOMATIC STEEL MILL CONTROL EQUIPMENT

WE are fully equipped to design and build all standard or special A. C. and D. C. Automatic Controls for any auxiliary motor drive in the Steel Mill or other Industrial Plants.

Bench-board Master Control has been one of our leading activities in recent months.

CLARK Control for Cranes has achieved unusual success in plants of the leading Steel Producers.

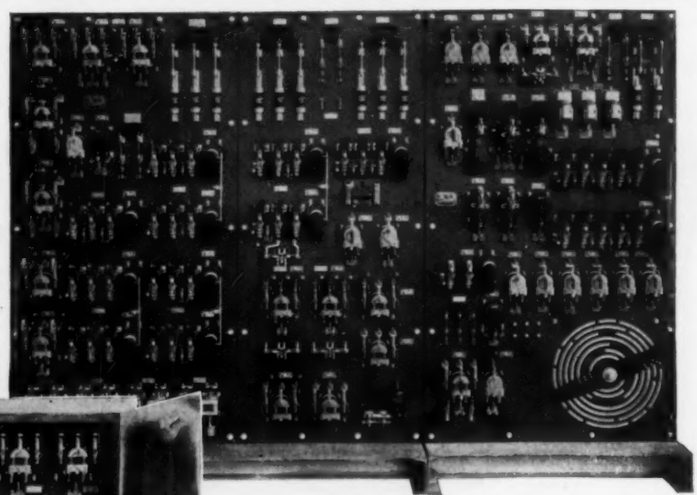
The illustrations to the right show Front and Rear Views of Clark "3C" Standard Full Magnetic Dynamic Lowering Controller for Crane Hoist.



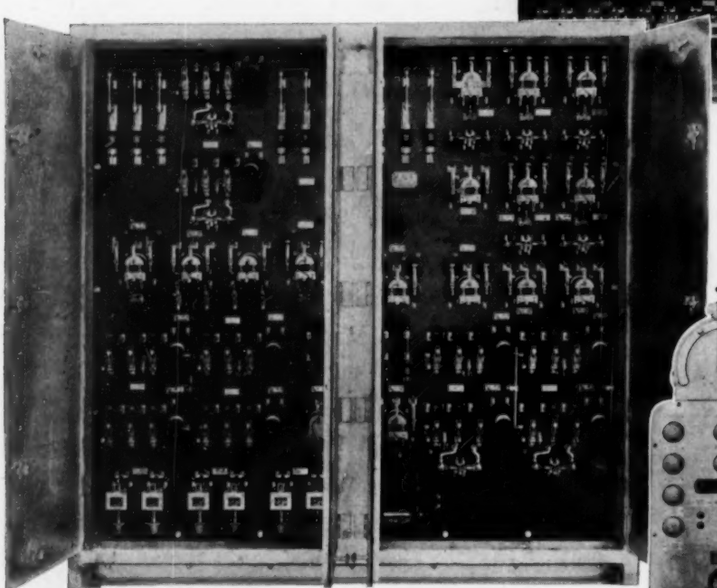
THE CLARK CONTROLLER CO.
1146 East 152nd St.
CLEVELAND, OHIO

CLARK
AUTOMATIC STEEL MILL CONTROL EQUIPMENT

WHILE it is true that these illustrations show Clark Automatic Control Panels built for a specific application, the real purpose of this pictoral message is to show that CLARK is completely capable and fully equipped to design and build all standard or special A. C. or D. C. Automatic Control for any auxiliary motor drive in the Steel Mill or other Industrial Plants.

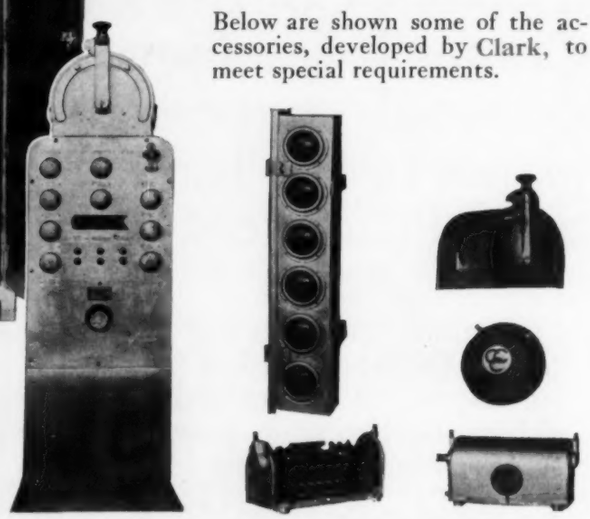


Above is a Clark Automatic Panel operating Roller and Catcher Tables and Automatic Screwdown on Roughing Mill by Mackintosh-Hemphill Company.



Above is a Clark Automatic Panel operating Roller and Catcher Tables at Finishing Mill, Double Pack Furnace Doors, Blowers and Conveyors by Wean Engineering Company.

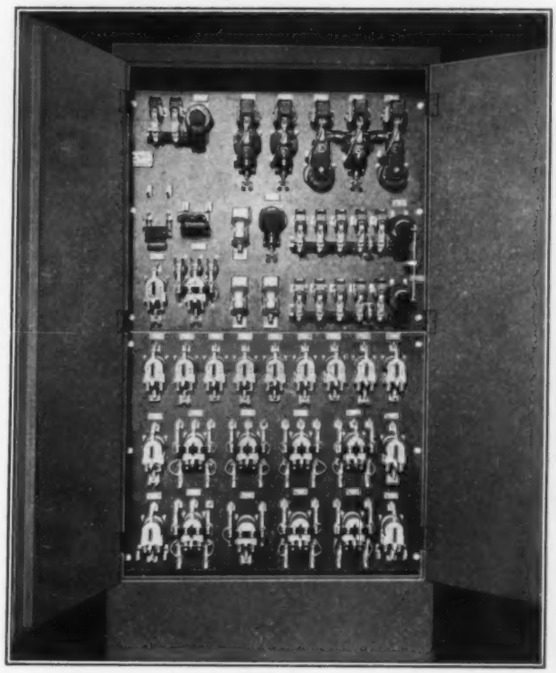
Below are shown some of the accessories, developed by Clark, to meet special requirements.

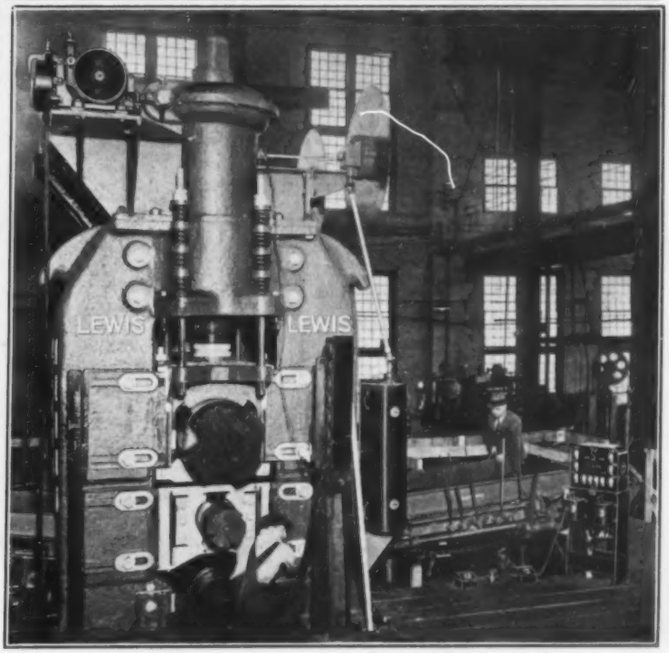


THE CLARK CONTROLLER CO.
1146 East 152nd St.
CLEVELAND, OHIO

CLARK

AUTOMATIC STEEL MILL CONTROL EQUIPMENT





STEADILY and surely increasing its scope, Clark-Sundh Control equipment is here shown as the complete electrical assistant to the Lewis Foundry and Machine Company's rapid rolling 3-High Roughing Mill with its accompanying Roll Tables.

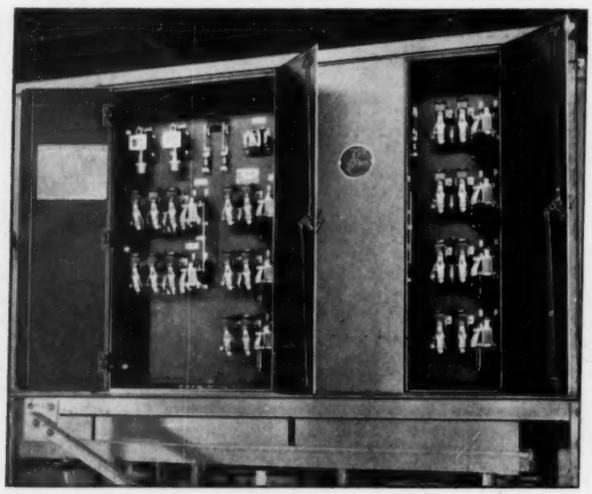
The Clark "3C" Brake, co-operating with a Clark-Sundh Magnetic Panel, a Clark "made-to-order" Limit Switch and a Clark made Signal Box automatically take care of the Screwdown while a separate Clark-Sundh Magnetic Panel handles the Roll Tables.

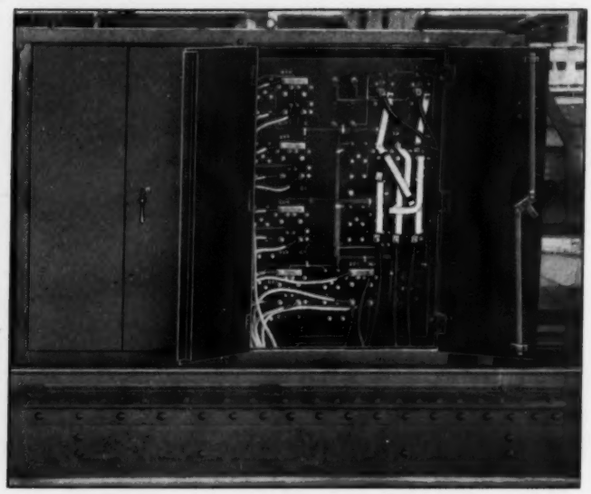
All governed by our special Master Control Station and Foot Switches as shown.

THE CLARK CONTROLLER CO.
1146 East 152nd St.
CLEVELAND, OHIO

CLARK

AUTOMATIC STEEL MILL CONTROL EQUIPMENT





BY courtesy of the Euclid-Armington Corporation, we are able to show one of their Cranes equipped with Clark A. C. Automatic Control. We have something of considerable interest for users of A. C. Cranes. Write to us for complete information.

THE CLARK CONTROLLER CO.
1146 East 152nd St.
CLEVELAND, OHIO

The Wean
CONTINUOUS STRIP PICKLER

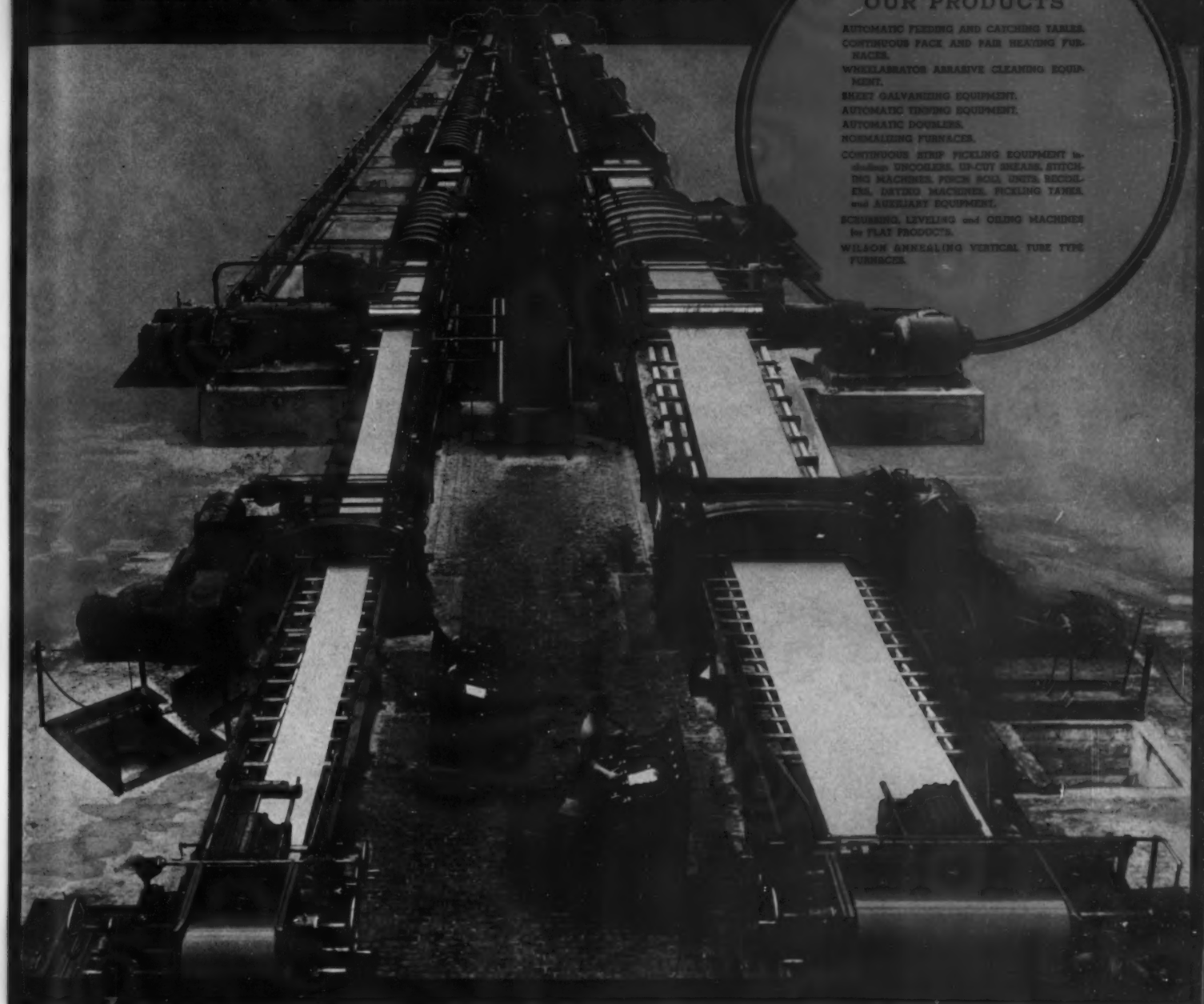
The WEAN CONTINUOUS PICKLING UNIT, now being offered to the flat rolled industry by the WEAN ENGINEERING CO., Inc., consists of machinery of special design to permit the most efficient production of the finest quality of pickled material.

Higher speeds are possible and greater tonnage procurable on the Wean Continuous Strip Pickling Lines by the use and arrangement of machines of special design.

THE CONTINUOUS PICKLING UNIT CAN BE FURNISHED COMPLETE FROM THE HANDLING OF THE HOT STRIP COIL TO THE FINISHED PRODUCT.

OUR PRODUCTS

AUTOMATIC FEEDING AND CATCHING TABLES.
CONTINUOUS PACK AND PAIR HEATING FURNACES.
WHEELABRATOR ABRASIVE CLEANING EQUIPMENT.
SHEET GALVANIZING EQUIPMENT.
AUTOMATIC TINNING EQUIPMENT.
AUTOMATIC DOUBLERS.
NORMALIZING FURNACES.
CONTINUOUS STRIP PICKLING EQUIPMENT including UNCOILERS, UP-CUT SHEARS, STITCHING MACHINES, PINCH ROLL UNITS, RECOILERS, DRYING MACHINES, PICKLING TANKS and AUXILIARY EQUIPMENT.
SCRUBBING, LEVELING and OILING MACHINES for FLAT PRODUCTS.
WILSON ANNEALING VERTICAL TUBE TYPE FURNACES.



The WEAN ENGINEERING CO. Inc.
WARREN, OHIO.

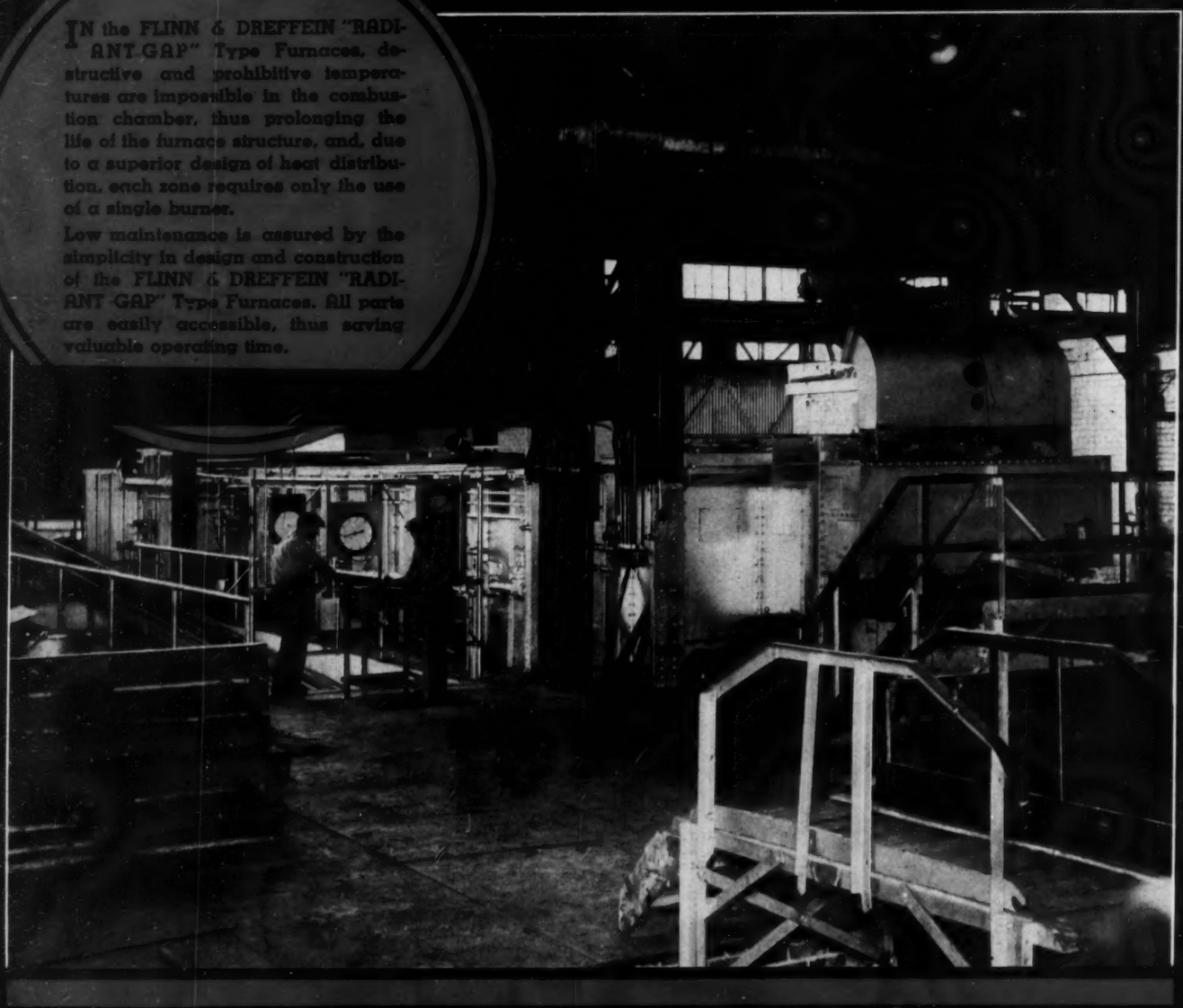
ASSOCIATE COMPANIES

The FLINN & DREFFEIN CO. The McKAY MACHINE CO. LEE WILSON ENGINEERING CO.

Low MAINTAINANCE *Cost*

IN the FLINN & DREFFEIN "RADIANT-GAP" Type Furnaces, destructive and prohibitive temperatures are impossible in the combustion chamber, thus prolonging the life of the furnace structure, and, due to a superior design of heat distribution, each zone requires only the use of a single burner.

Low maintenance is assured by the simplicity in design and construction of the FLINN & DREFFEIN "RADIANT-GAP" Type Furnaces. All parts are easily accessible, thus saving valuable operating time.



The above illustration is used by courtesy of THE NILES ROLLING MILL

FLINN & DREFFEIN COMPANY

CHICAGO, ILLINOIS.

ASSOCIATED COMPANY

THE WEAN ENGINEERING CO., Inc. • Warren, Ohio

The McKAY STRIP UNCOILER

WHEN uncoiling hot rolled strip for the first time a McKAY STRIP UNCOILER should be used. This will insure the strip against objectionable coil breaks, thus eliminating over-pickling of broken surfaces.

Material processed by the McKAY STRIP UNCOILER remains thoroughly ductile and will not cross-break in subsequent operations.

McKAY UNCOILER FOR 54" STRIP

THE McKAY MACHINE COMPANY

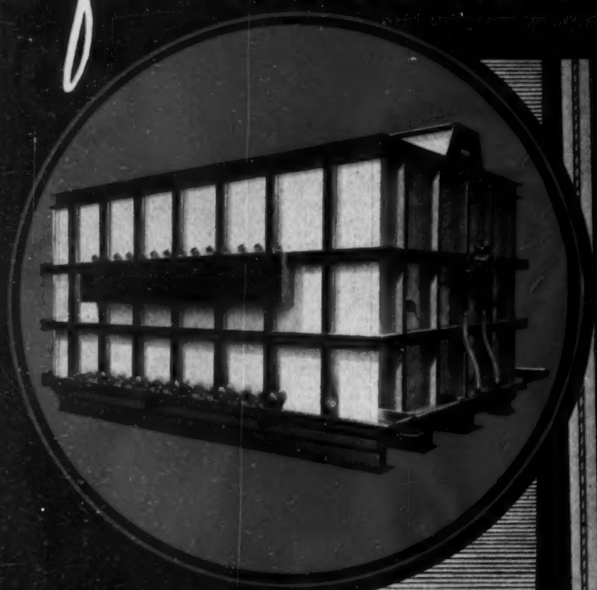
ENGINEERS AND MANUFACTURERS OF SHEET, TIN AND STRIP MILL EQUIPMENT

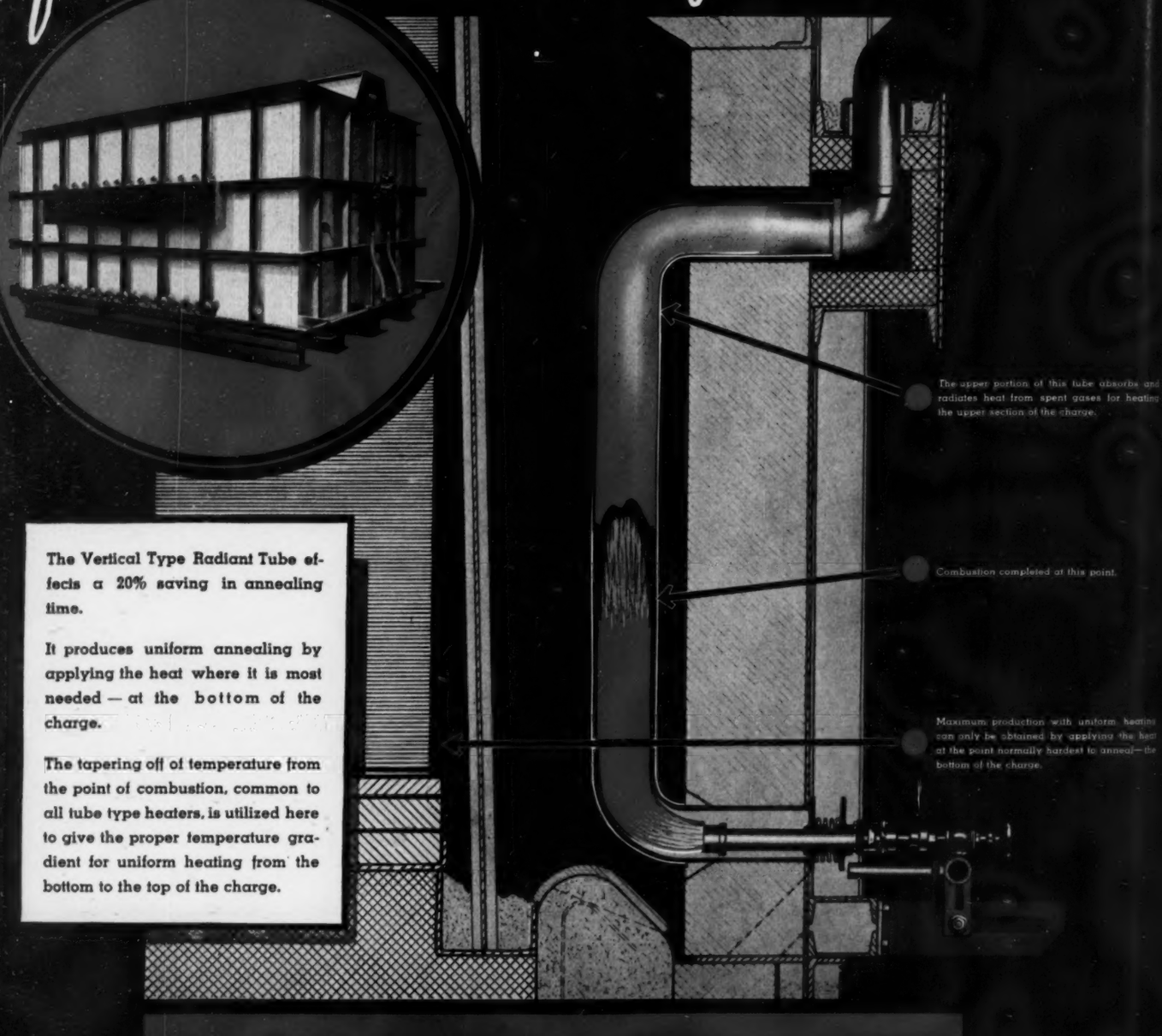
YOUNGSTOWN, OHIO

ASSOCIATED COMPANY

THE WEAN ENGINEERING CO., Inc. • Warren, Ohio

VERTICAL Tubes
for better Annealing –




The upper portion of this tube absorbs and radiates heat from spent gases for heating the upper section of the charge.
Combustion completed at this point.
Maximum production with uniform heating can only be obtained by applying the heat at the point normally hardest to anneal—the bottom of the charge.

The Vertical Type Radiant Tube effects a 20% saving in annealing time.

It produces uniform annealing by applying the heat where it is most needed — at the bottom of the charge.

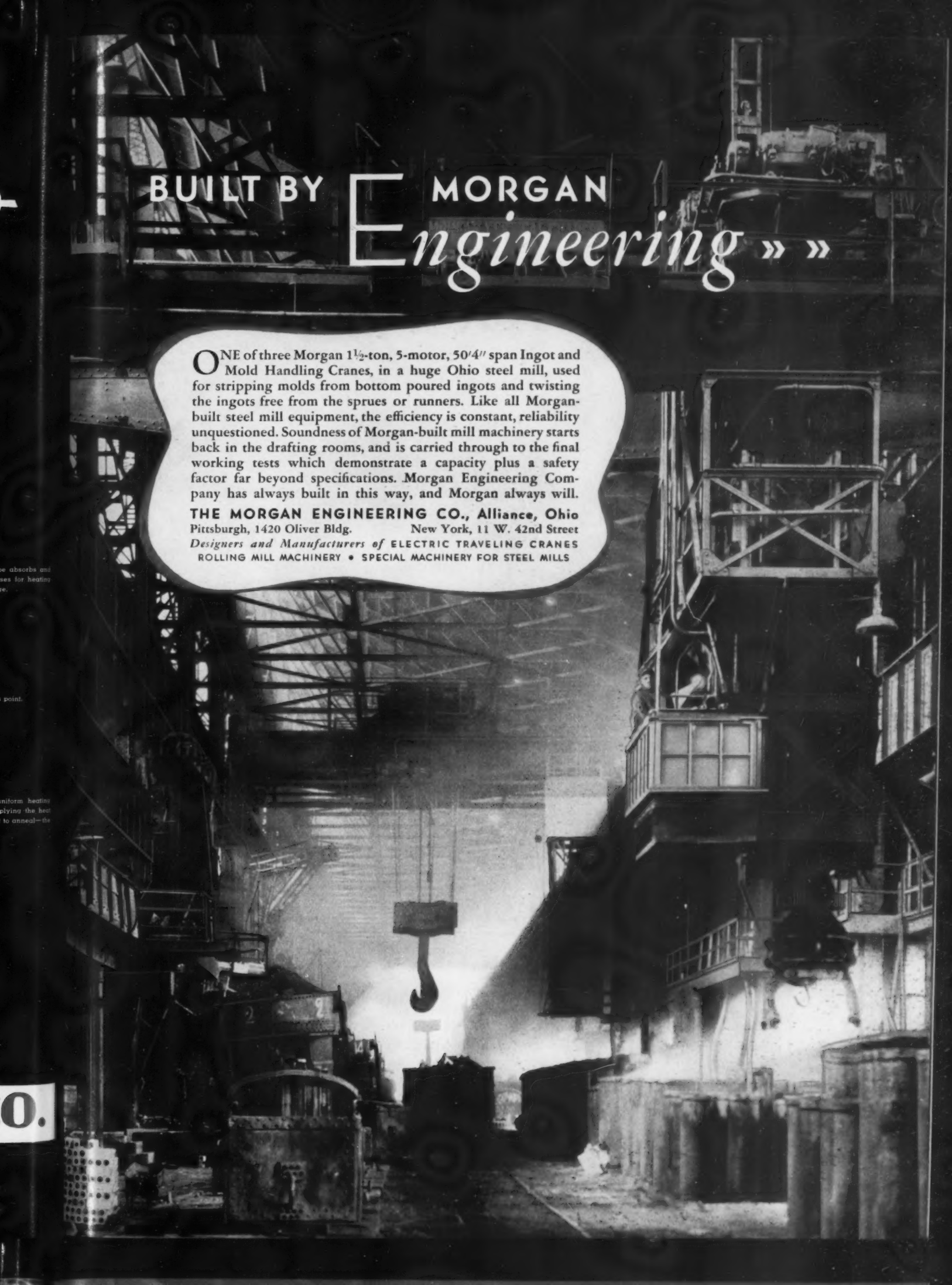
The tapering off of temperature from the point of combustion, common to all tube type heaters, is utilized here to give the proper temperature gradient for uniform heating from the bottom to the top of the charge.

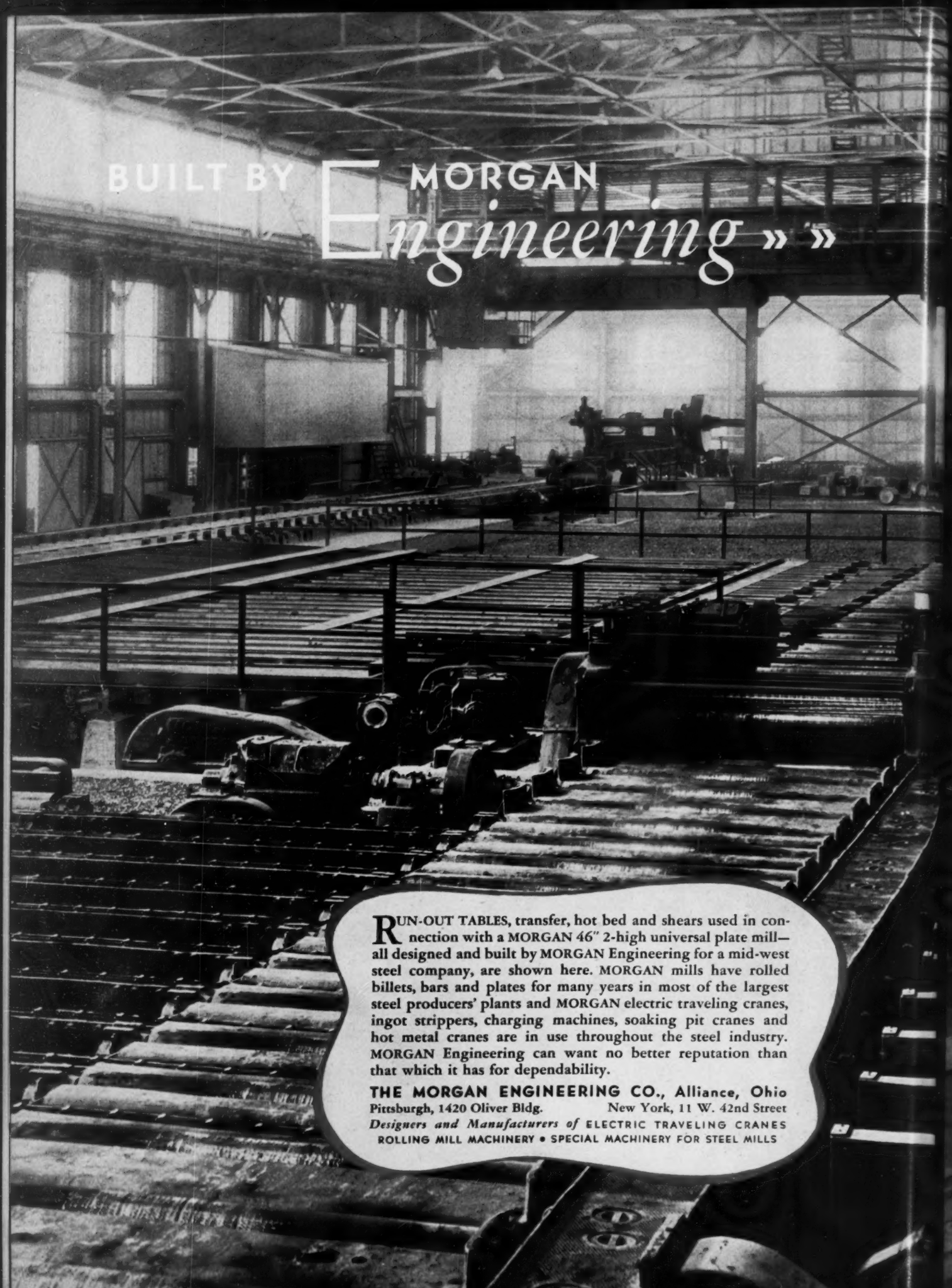
An Exclusive Development of

LEE WILSON ENGINEERING CO.

1370 Blount Street • Cleveland, Ohio

SOLD BY THE WEAN ENGINEERING CO., INC., WARREN, OHIO


BUILT BY MORGAN
Engineering » »
ONE of three Morgan 1½-ton, 5-motor, 50′4″ span Ingot and Mold Handling Cranes, in a huge Ohio steel mill, used for stripping molds from bottom poured ingots and twisting the ingots free from the sprues or runners. Like all Morgan-built steel mill equipment, the efficiency is constant, reliability unquestioned. Soundness of Morgan-built mill machinery starts back in the drafting rooms, and is carried through to the final working tests which demonstrate a capacity plus a safety factor far beyond specifications. Morgan Engineering Company has always built in this way, and Morgan always will.
THE MORGAN ENGINEERING CO., Alliance, Ohio
Pittsburgh, 1420 Oliver Bldg. New York, 11 W. 42nd Street
Designers and Manufacturers of ELECTRIC TRAVELING CRANES
ROLLING MILL MACHINERY • SPECIAL MACHINERY FOR STEEL MILLS



RUN-OUT TABLES, transfer, hot bed and shears used in connection with a MORGAN 46" 2-high universal plate mill—all designed and built by MORGAN Engineering for a mid-west steel company, are shown here. MORGAN mills have rolled billets, bars and plates for many years in most of the largest steel producers' plants and MORGAN electric traveling cranes, ingot strippers, charging machines, soaking pit cranes and hot metal cranes are in use throughout the steel industry. MORGAN Engineering can want no better reputation than that which it has for dependability.

THE MORGAN ENGINEERING CO., Alliance, Ohio
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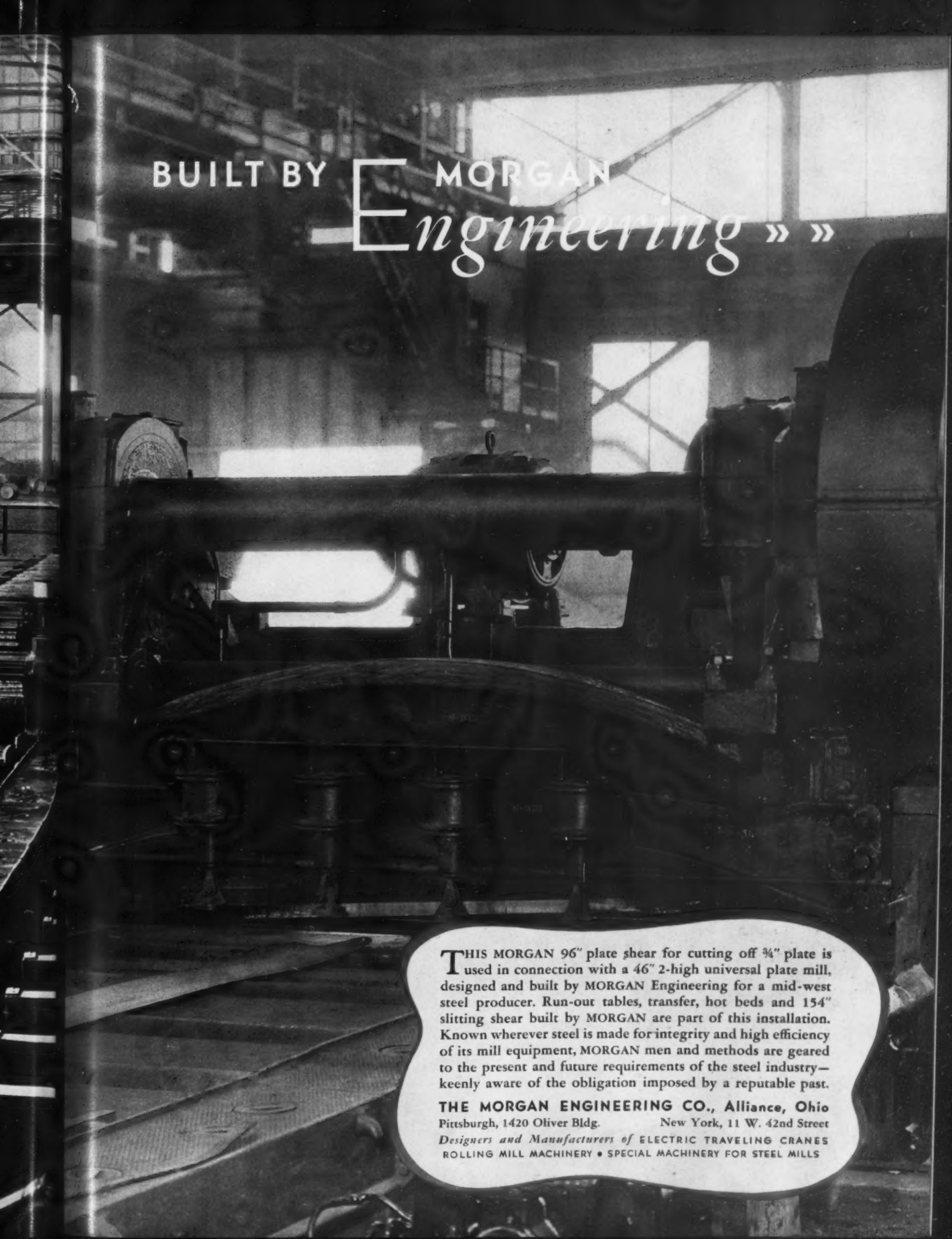
ROLLING MILL MACHINERY • SPECIAL MACHINERY FOR STEEL MILLS



THIS MORGAN 96" plate shear for cutting off ¾" plate is used in connection with a 46" 2-high universal plate mill, designed and built by MORGAN Engineering for a mid-west steel producer. Run-out tables, transfer, hot beds and 154" slitting shear built by MORGAN are part of this installation. Known wherever steel is made for integrity and high efficiency of its mill equipment, MORGAN men and methods are geared to the present and future requirements of the steel industry—keenly aware of the obligation imposed by a reputable past.

THE MORGAN ENGINEERING CO., Alliance, Ohio

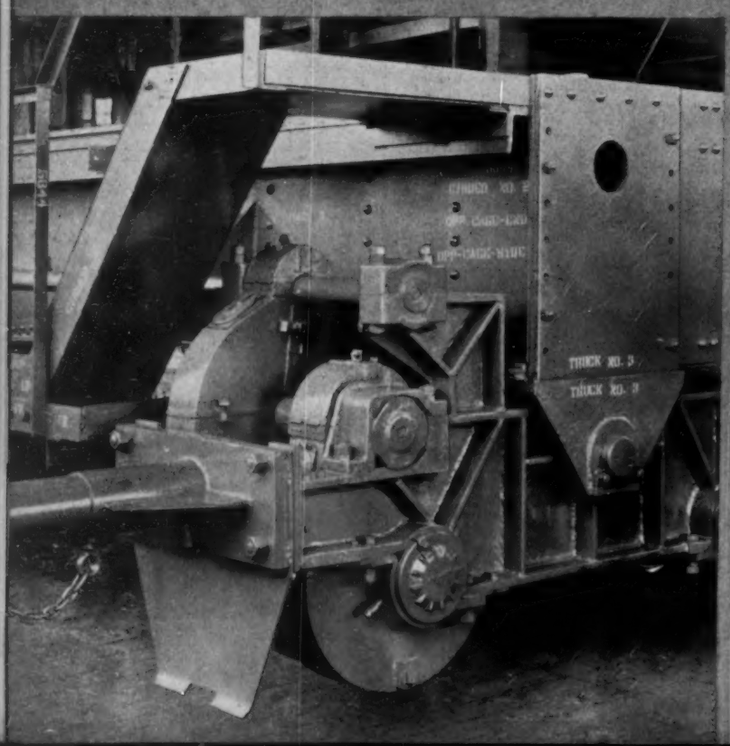
Pittsburgh, 1420 Oliver Bldg. New York, 11 W. 42nd Street

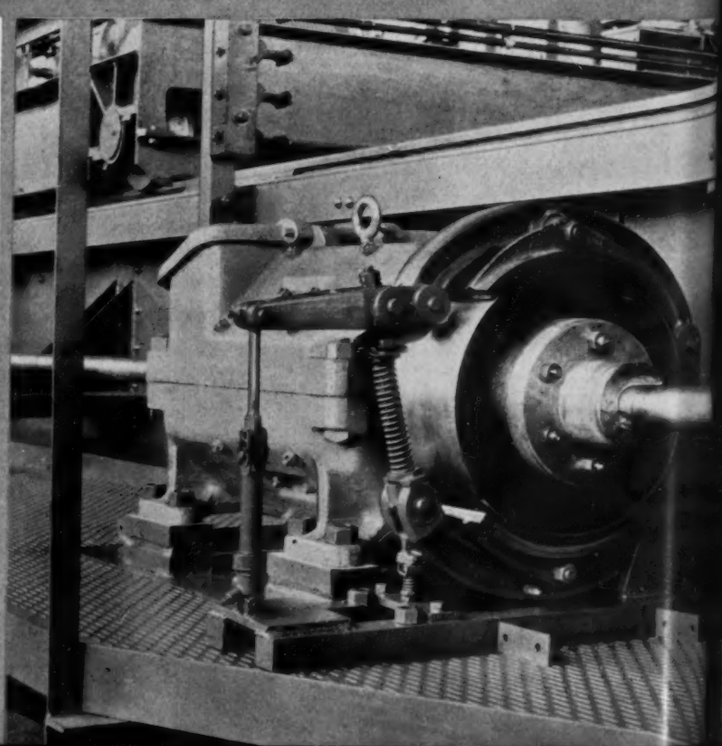
Designers and Manufacturers of ELECTRIC TRAVELING CRANES
ROLLING MILL MACHINERY • SPECIAL MACHINERY FOR STEEL MILLS

WELDING OPERATIONS ON THE MORGAN CRANE TROLLEY *at right, opposite*

A close-up view of one of the four welded end-trucks of the Crane assembly shown at right, opposite page. Note wholly enclosed gear reductions and compactness of the design, permitting a more rigid, stronger unit than otherwise possible.

A close-up view of the Morgan External Hydraulic Brake as applied to a 45-HP bridge motor on this same Crane. At right, brake can be seen mid-way of the Crane bridge line-shaft. This new Morgan brake is made in three standard sizes to fit any make of motor.



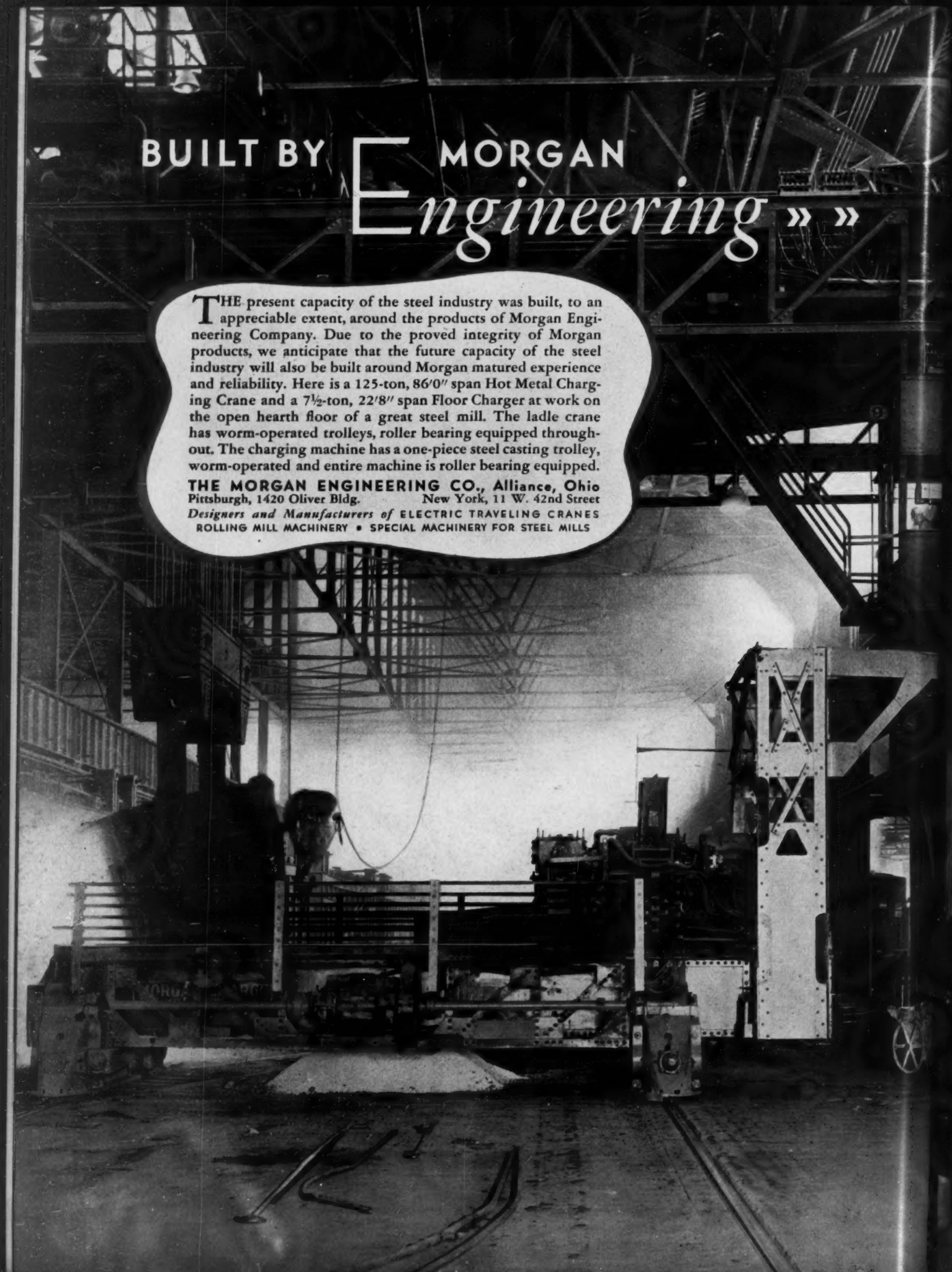


15-Ton, 4-Motor, 110′ 6″ Span, Double Drum Mill Crane

Designed and Built by Morgan Engineering » » » »

One of Six Cranes Recently Constructed for a Large Steel Producer

The first manufacturer of electric traveling cranes, established in 1868, Morgan Engineering Company is today, as then, the leading manufacturer of such equipment. Roller-bearing throughout, this is one of the types of mill cranes produced in the Morgan plants for steel mills and other heavy industries requiring such machinery for materials handling operations.



BUILT BY MORGAN *Engineering* » »

THE present capacity of the steel industry was built, to an appreciable extent, around the products of Morgan Engineering Company. Due to the proved integrity of Morgan products, we anticipate that the future capacity of the steel industry will also be built around Morgan matured experience and reliability. Here is a 125-ton, 86′0″ span Hot Metal Charging Crane and a 7½-ton, 22′8″ span Floor Charger at work on the open hearth floor of a great steel mill. The ladle crane has worm-operated trolleys, roller bearing equipped throughout. The charging machine has a one-piece steel casting trolley, worm-operated and entire machine is roller bearing equipped.

THE MORGAN ENGINEERING CO., Alliance, Ohio
Pittsburgh, 1420 Oliver Bldg. New York, 11 W. 42nd Street
Designers and Manufacturers of ELECTRIC TRAVELING CRANES
ROLLING MILL MACHINERY • SPECIAL MACHINERY FOR STEEL MILLS

BUILT BY MORGAN *Engineering* » »

BUILDING large machinery for other manufacturers, MORGAN Engineering Company itself must have still larger machinery for the job. A trip through the heavy machine shops and assembly rooms in our plants will assure you that whatever the size of machine you need, MORGAN has facilities for its construction. Here is a 1000-ton Hydraulic Flanging Press built by MORGAN for Lukens Steel Company, pressing brake drums for oil well drilling equipment in Lukens' Flanging Department. The drums produced on this press measure 51 5/8" I. D. x 10 3/8" deep x 1 1/2" thick. Lukens operates a battery of MORGAN presses.

THE MORGAN ENGINEERING CO., Alliance, Ohio

Pittsburgh, 1420 Oliver Bldg. New York, 11 W. 42nd Street

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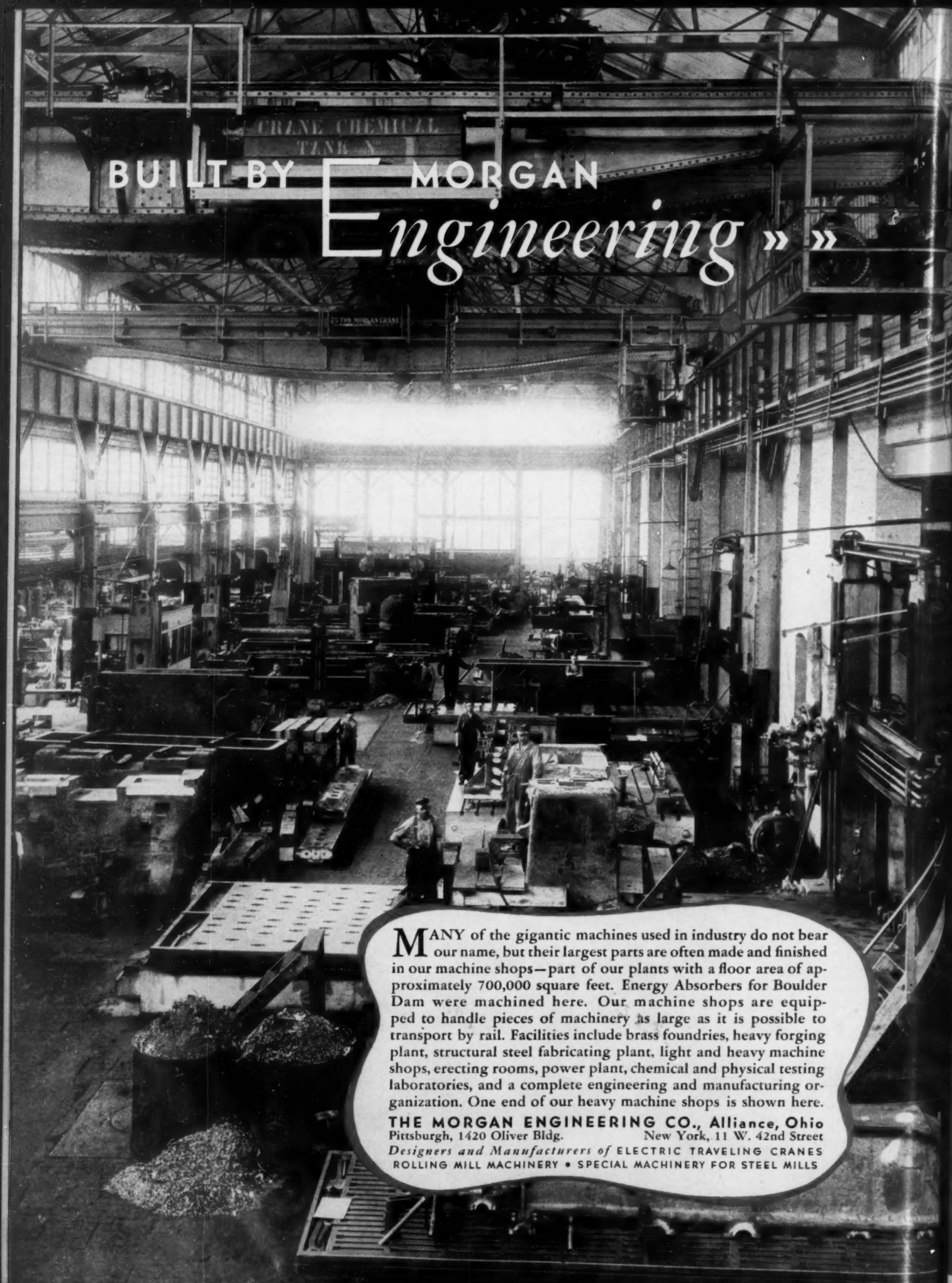

BUILT BY MORGAN *Engineering* » »

MANY of the gigantic machines used in industry do not bear our name, but their largest parts are often made and finished in our machine shops—part of our plants with a floor area of approximately 700,000 square feet. Energy Absorbers for Boulder Dam were machined here. Our machine shops are equipped to handle pieces of machinery as large as it is possible to transport by rail. Facilities include brass foundries, heavy forging plant, structural steel fabricating plant, light and heavy machine shops, erecting rooms, power plant, chemical and physical testing laboratories, and a complete engineering and manufacturing organization. One end of our heavy machine shops is shown here.

THE MORGAN ENGINEERING CO., Alliance, Ohio
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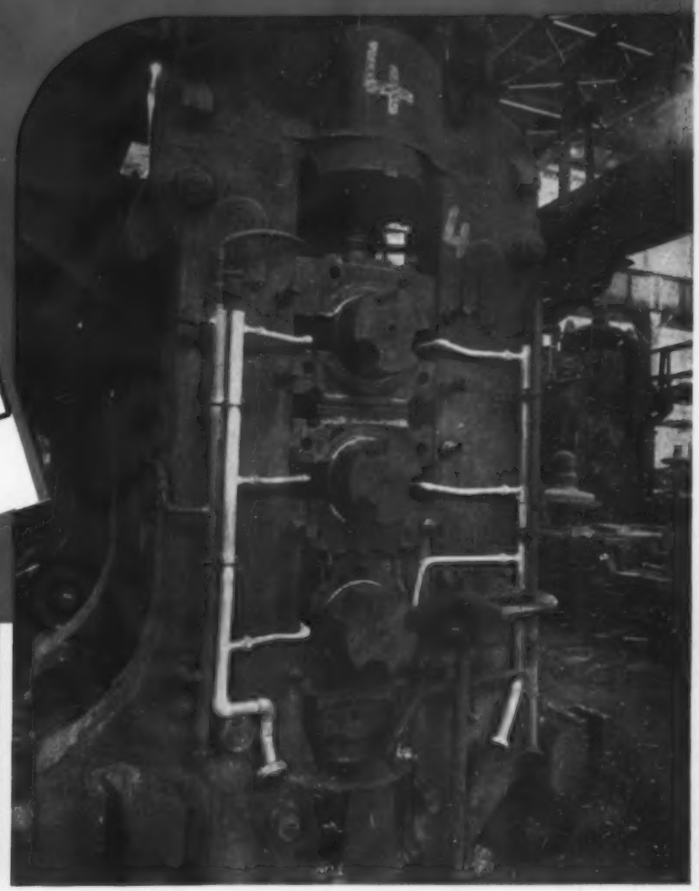
Designers and Manufacturers of ELECTRIC TRAVELING CRANES
ROLLING MILL MACHINERY • SPECIAL MACHINERY FOR STEEL MILLS

Ryertex Bearings Make Good
on Inland Steel Company's Large Structural and Rail Mill

Average Power Saving—28-2/3%
Based on 100 rollings comparing Babbitt and Ryertex on the same sections.

group of the
rtex Bearings
d in the Mill.



Installing the Bearings and water pipes for lubricating them.

28" 3-Stand 3-High Structural and Rail Mill

Sections Rolled—I-Beams, 7" to 24"—Channels, 10" to 15"—Angles, 6 x 3½" to 8 x 8"—Standard Rails, 80 to 131 lbs.—Sheet Piling, 8½" to 19⅝" wide from straight webb to 6" deep arch—Rounds—Squares—Tie Plates—Splice Bars.

This mill completely equipped with Ryertex since June, 1934 and based upon wear of Ryertex Bearings to date, it is estimated that the life of the Ryertex will be 4 to 5 times that of babbitt.

Average Power Saving—28-2/3% (See Chart).

Complete elimination of grease.

Increased speed under load and less adjustment of rolls has resulted in maintaining steadier sections and better deliveries.

Only slightly more water used than on babbitt bearings.

Condition of roll necks greatly improved showing a much smoother surface than on babbitt bearings.

Due to eliminating grease on rolls, much cleaner and safer mill.

Write for Bulletin on Ryertex Bearings.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Detroit, Cincinnati, Philadelphia, Boston, Buffalo, Jersey City

RYERSON

An All Steel Air Filter --That Cleans Itself --and Never Clogs

"DOUBLE DUTY" MODEL "L"

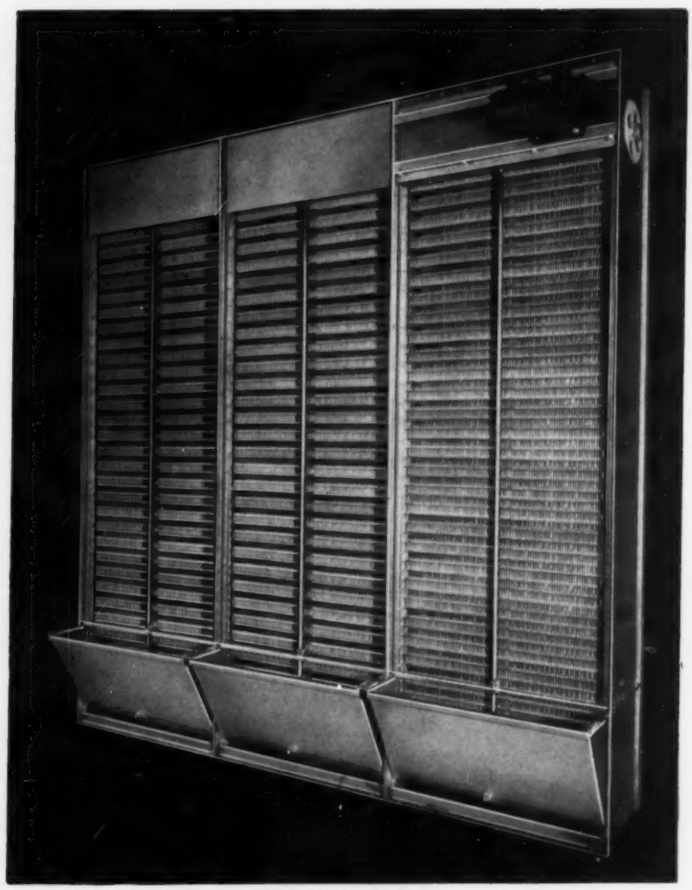
Double-Pass Efficiency—Two complete filtering actions through curtain, with air space between. The effective design of the individual baffle plates, with their rasp-like surfaces, gives the highest cleaning efficiency possible by the viscous impingement method.

Constant Air Delivery—This vital factor assured by the non-clog feature of the filter plates. Initial resistance is the final resistance, never varying day in and day out, regardless of the dust content of the air.

True Impingement—Perfectly carried out in "Double Duty" by acute deflections against the broad and roughened surfaces of the baffle plates.

Self-Cleaning and Automatic—Long immersion of filter plates in the oil bath causes complete release of dust particles. Plates emerge absolutely cleaned and heavily filmed with oil.

No Oil Entrainment—The angling position of the stamped steel louvre plates causes surplus oil to always drain downward and against the direction of air travel. Entrainment of oil is thereby positively prevented.



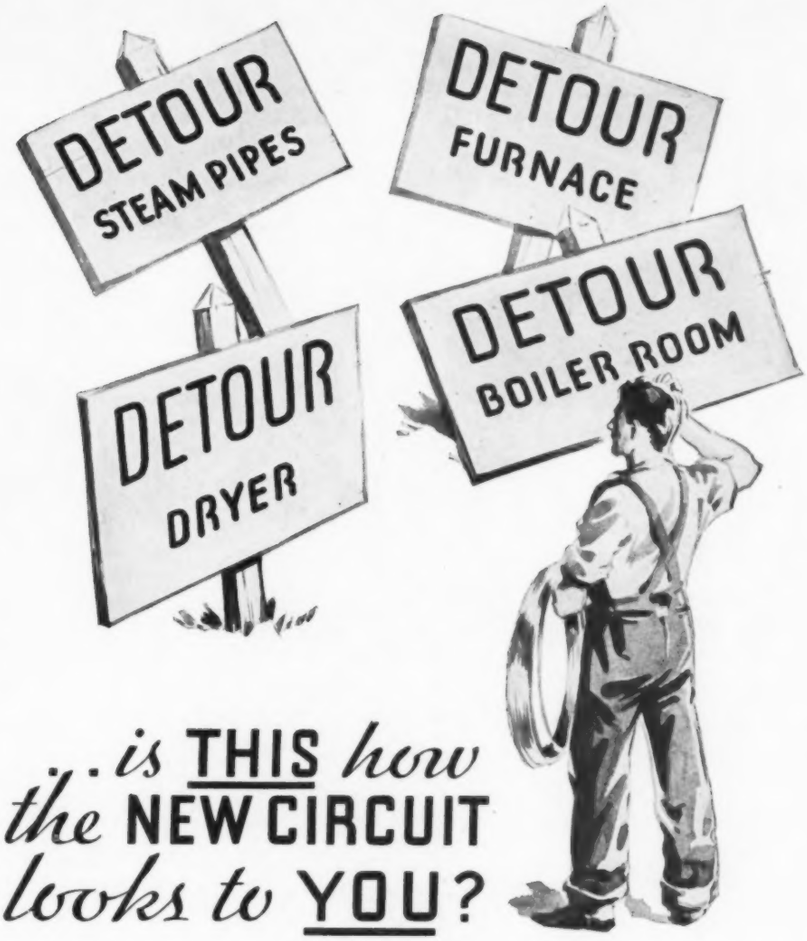
THREE SECTION FILTER 9'3" HIGH BY 9'0" WIDE; CAPACITY 30,000 C.F.M.
"Double Duty" Model "L" Air Filters are made in capacities up to 600,000 C.F.M.

THE IDEAL FILTER For Steel Mill Service

INDEPENDENT AIR FILTER COMPANY, Inc.

215 West Ohio St., Chicago, Illinois

Representatives in all principal cities



. . . *is* THIS *how the* NEW CIRCUIT *looks to* YOU?

Of course you don't actually *see* those signs in your plant! They are in your experience. You've used ordinary wire so long and you're so well acquainted with its shortcomings that you just naturally shy away from the hot spots without analyzing why!

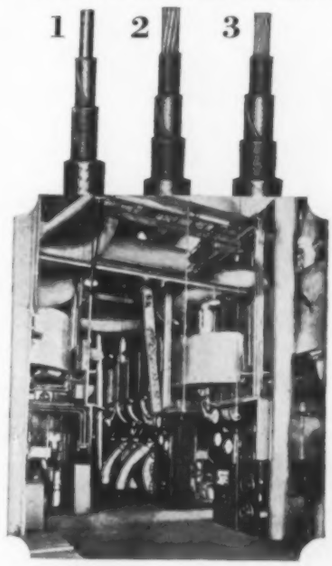
Just for a change, wouldn't it be a relief to run conduit straight to the point you want to reach regardless of whether the path takes it over a boiler, near a kiln, or alongside a steam header?

You can do that. And it's a lot easier than you probably think, too. How? Just use Rockbestos A.V.C. wire. Why? Because this unique wire is insulated — not with a material that is affected by heat — but with a felted and impregnated wall of asbestos reinforced with an embedded insert of varnished cambric, the whole covered with a tough, braided asbestos jacket. (Though lead and armor coverings can be supplied where necessary.)

Rockbestos A.V.C. wire and cable is made in all wanted sizes up to 2,000,000 C.M. and for service voltages up to 7,500. Single, duplex and multi-conductor types. Send for our catalog-handbook of these modern heatproof wires and their uses. Try a coil of it on your next job. Saves time, wire and conduit. Rockbestos Products Corporation, New Haven, Conn.

Here is a typical Rockbestos A.V.C. wiring installation. Labor costs are high on jobs like these—it pays to use Rockbestos, the wire with the permanent insulation. Recommended wires are:

1. **A.V.C. Boiler Room Wire.**
2. **A.V.C. Power Cable.**
3. **A.V.C. Motor Lead Cable.**



ROCKBESTOS

—the wire with permanent insulation

Announcing

A NEW Line of D-c Contactors

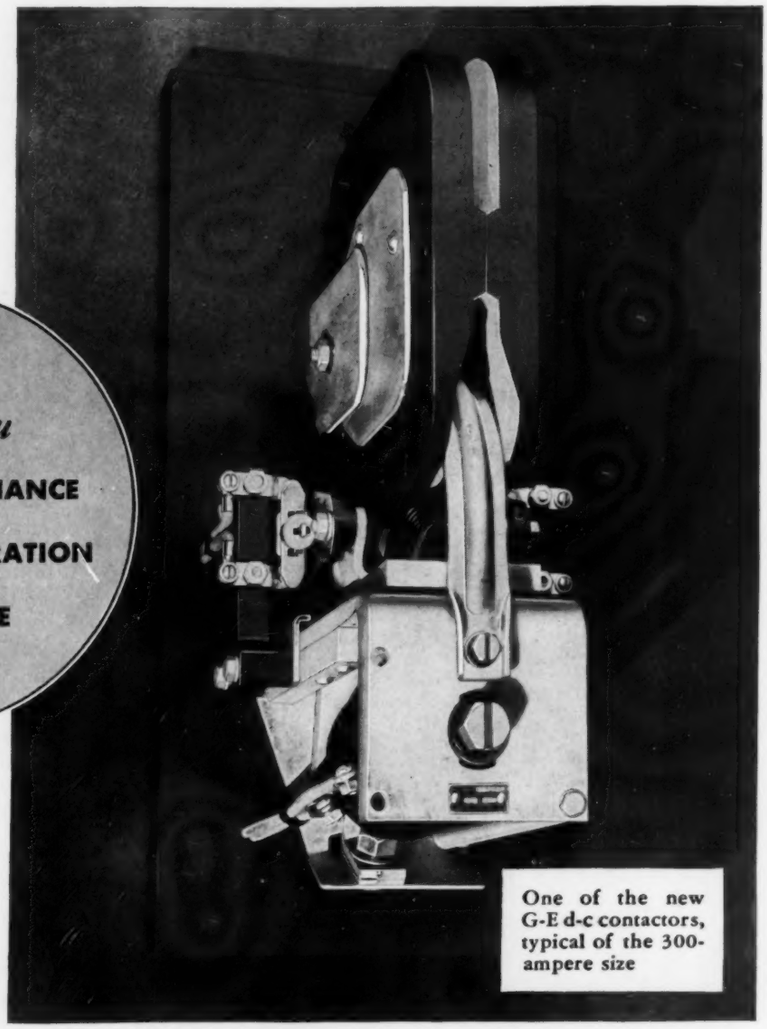
That Will Cut Your Maintenance Costs

Designed to Give You

REDUCED MAINTENANCE

CONTINUOUS OPERATION

LONG SERVICE



One of the new G-E d-c contactors, typical of the 300-ampere size

ESTIMATE for yourself the money you would save if you could eliminate the maintenance on the pin-type bearings in your d-c contactors in heavy-duty service.

Here is an opportunity to make that saving!

General Electric has developed a line of husky d-c contactors with new "rocker-type" bearings that will stand up under the toughest kind of service. Abrasive dust cannot cause wear on the "rocker" bearings, nor will an accumulation of it affect the positive action of the contactor. In fact, these bearings, plus a construction that permits easy access to all parts, make this new line an outstanding departure in d-c contactor design.

These new G-E contactors, through the 2500-ampere size, will be on display at the A. I. & S. E. E. meeting, Pittsburgh, Sept. 24-26, 1935, Booths 10 and 38.

General Electric Company, Schenectady, New York.

080-54

GENERAL ELECTRIC

Some industrial heating needs:

now being served by CHROMALOX HEATING UNITS

• • • • • • •

Rolls . . Ovens . . Asphalt Tanks . . Melting Pots (babbitt, lead, solder, tin, grease, wax, etc.) . . Oil and Lubricating Systems . . Tempering Baths . . Heaters for drying Transformer Cores and Motors . . Heaters to keep temperatures above freezing point for Fire Extinguishers, Pipe Lines, Float Switch Chambers, Meters . . Heaters for remote places such as Crane Cabs, Pump Houses, Sub-Stations, Watchmen's Houses, Oil and Fuel Storage Rooms . . for occasional use such as First Aid Rooms, or overtime in Offices or Plant Departments.

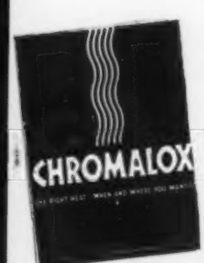
CHROMALOX ELECTRIC HEATING UNITS

economically solve many heating problems

Every day brings us new industrial heating needs, which our engineers meet through some new application of standard Chromalox Units. For instance a manufacturer writes: "We want to heat 100 gallons of quenching oil 100 deg. while our hardening furnace is coming up to heat—15 to 30 minutes. The oil tank has a water jacket to cool the quenching oil. Current available, 220 volts, 60-cycle, both single-phase and three-phase."

We answered: "In the conditions you state, 40 kw. of electric heat would be needed. However, if the water jacket can be drained before heating the oil, or if one hour can be allowed for bringing the oil to heat, 20 kw. would suffice. On this basis we suggest the use of four Chromalox Immersion Heaters, steel sheath construction, Type BLC, 230-volts, 5 kw. Three of these heaters to be connected on the 3-phase line, automatically controlled by thermostat and magnetic contactor. The fourth heater to be connected across the single-phase line and controlled manually."

Chromalox Units, built in practically every type and capacity that industry needs, lend themselves to the easy solution of countless problems.



Our Engineering Department is ready to help you

A rough pencil sketch and a few words of description will enable our engineers to work out the correct solution of any heating problem you have. No obligation.

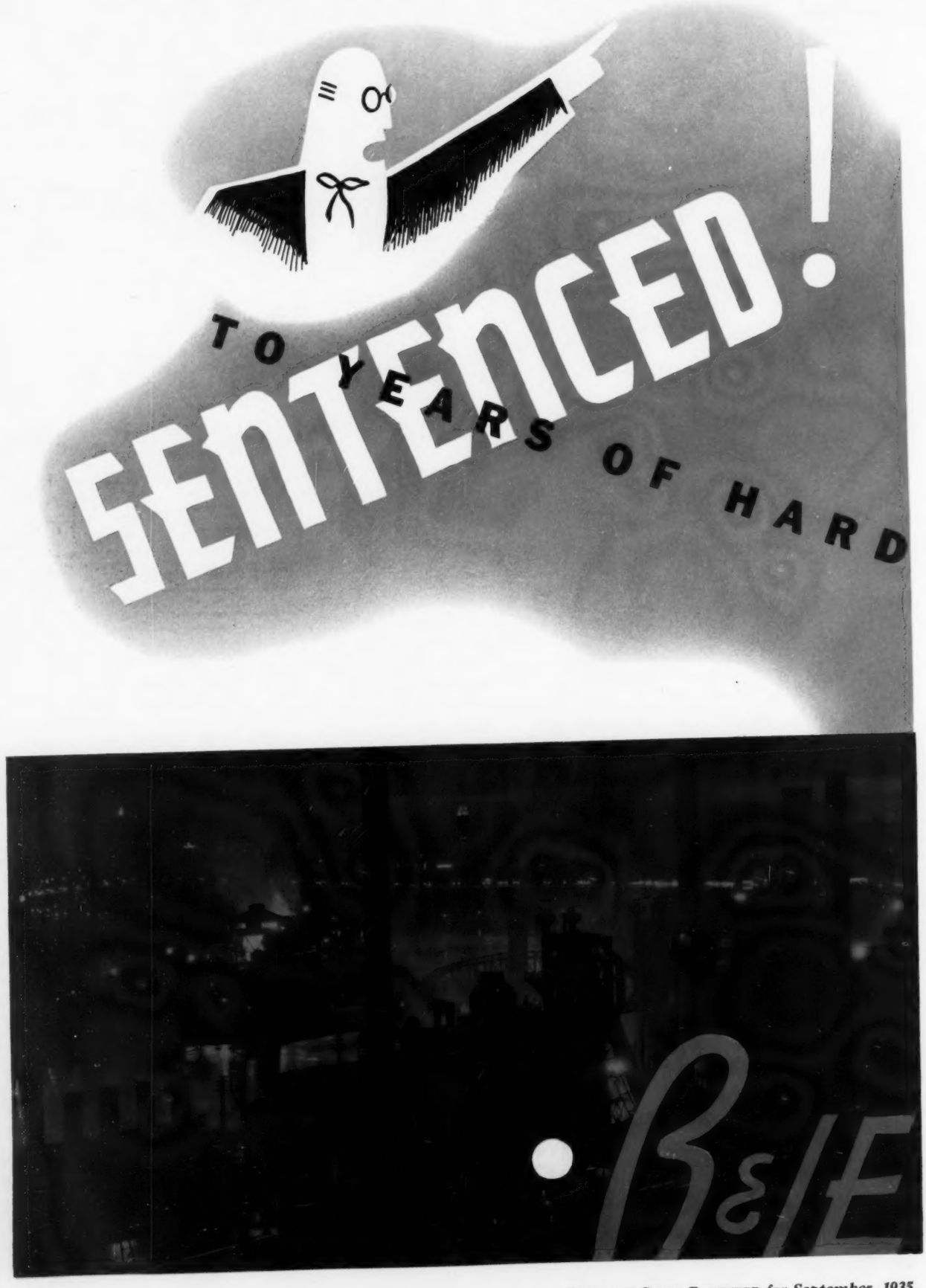
And for immediate information on Chromalox products, send the coupon below with your business letterhead, for a copy of the Chromalox Book of Electric Heat.

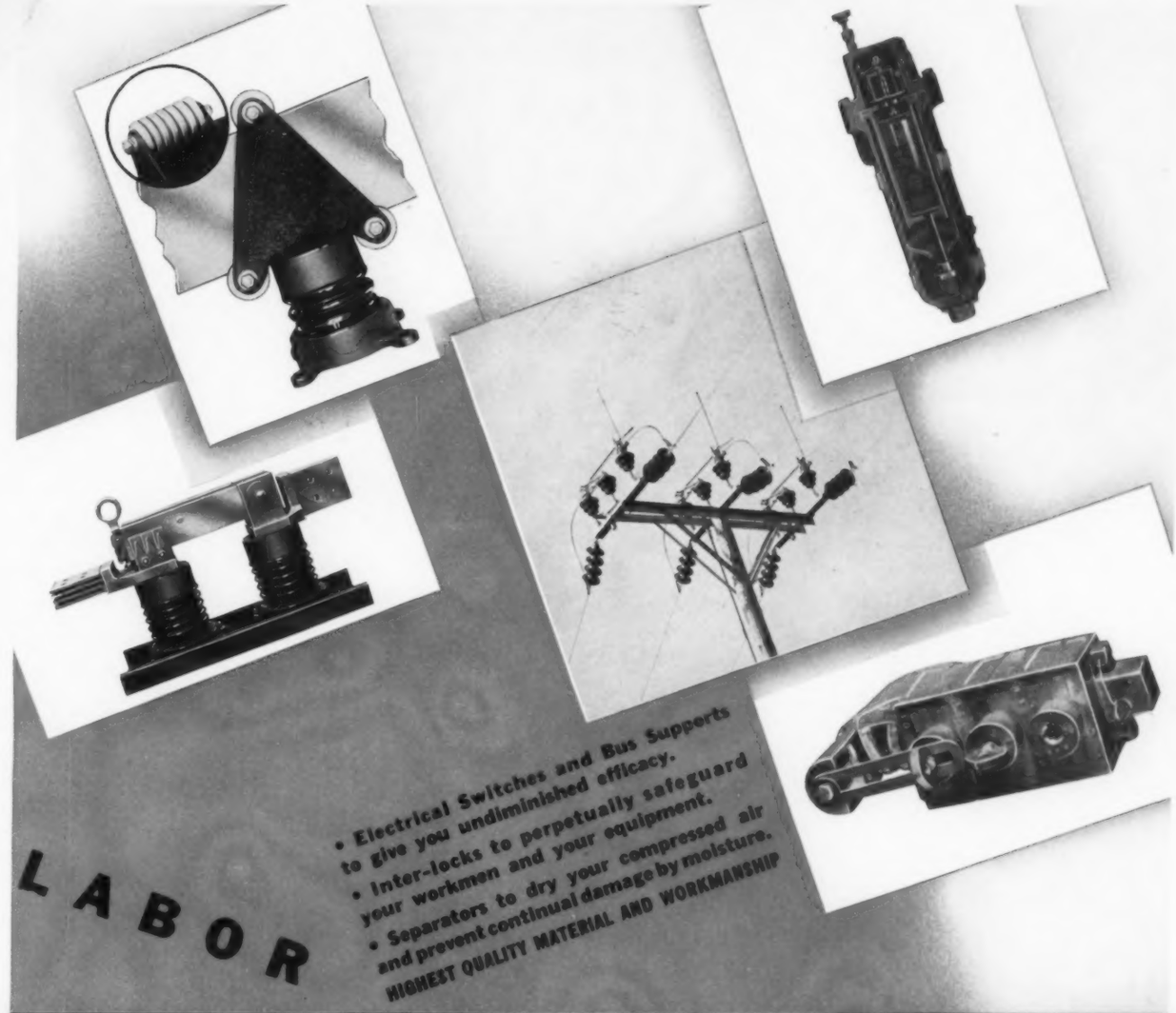
EDWIN L. WIEGAND CO.
7545 Thomas Blvd., Pittsburgh, Pa.

Without obligation, send me the CHROMALOX BOOX of ELECTRIC HEAT.

Name_____

Position_____


SENTENCED!
TO YEARS OF HARD
B&E


LABOR
• Electrical Switches and Bus Supports to give you undiminished efficacy.
• Inter-locks to perpetually safeguard your workmen and your equipment.
• Separators to dry your compressed air and prevent continual damage by moisture.
HIGHEST QUALITY MATERIAL AND WORKMANSHIP

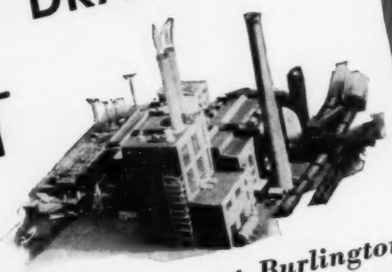
HI-PRESSURE CONTACT EQUIPMENT
RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
© ALTWATER BRO.

WORLD'S LARGEST

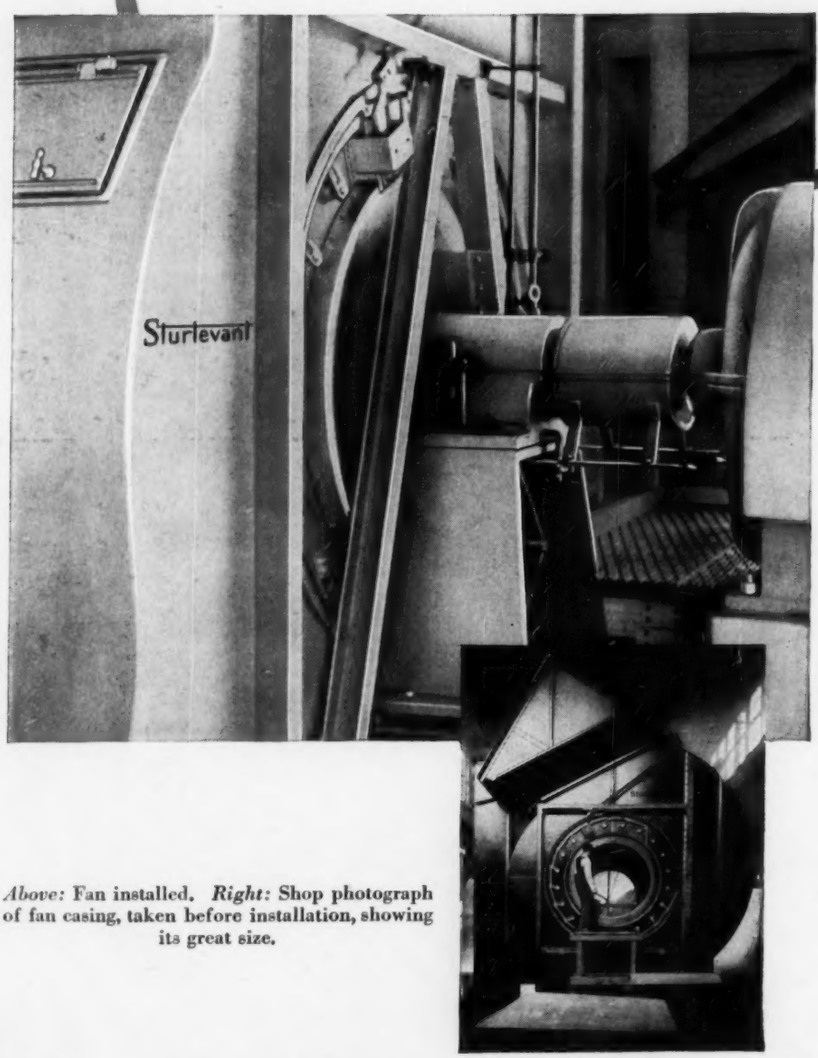
HEAVY DUTY INDUCED DRAFT FAN

..a Sturtevant

REG. U.S. PAT. OFF.



....at Burlington Generating Station, Public Service Electric and Gas Company, N.J.



Above: Fan installed. *Right:* Shop photograph of fan casing, taken before installation, showing its great size.

This giant Sturtevant Vane Control Fan serves a 525,000 pound high pressure Combustion Engineering Company boiler. Fan capacity is 335,000 C.F.M.

Fan wheel alone weighs over 2½ tons. It is almost 9 feet in diameter. Has a shaft 16 inches in diameter and 23 feet long. The casing towers 22 feet in height. Total weight of complete fan and bases: 80,000 lbs.

Forced draft for this same boiler is also supplied by a Sturtevant V.C. Fan. Capacity: 168,000 C.F.M.

1,718,835,000 pounds of steam (an average of 424,000 pounds per hour) were produced by the boiler served by these fans, on a continuous run from November 24, 1933 to May 11, 1934.

The efficient and reliable operation of these fans has fully justified their selection by United Engineers and Constructors, Inc., Philadelphia, Pa.

B. F. STURTEVANT COMPANY

Main Offices: Hyde Park, Boston, Mass.

Branch Offices in Other Cities

B. F. STURTEVANT CO. of CANADA, Ltd., GALT.

Sales Offices in Toronto and Montreal

Representatives in Principal Canadian Cities

DRAFT FANS · TURBINES · GEARS · ECONOMIZERS · AIR HEATERS

One of several Whiting Traveling Cranes furnished Inland Steel Co. for its new sheet mill at Indiana Harbor, Indiana

Close-up view of the main hoist gear unit of a Whiting 40-ton steel mill crane with gear cover removed

The Crane with the "Speed-Reducer" Drives

• Herringbone-geared, Hyatt roller bearing, "speed reducer" drives are an exclusive feature of Whiting Tiger Mill Type Cranes. Each gear and pinion of the main hoist is held in permanent alignment through mounting on a one-piece steel frame. Bearings as well as gears and pinions have splash lubrication. This very compact, rugged main-hoist unit, completely enclosed in an oil-tight steel housing, is in reality a speed reducer of the first quality. It operates smoothly and quietly, with a minimum of wear.

• Whiting Tiger Mill Type cranes have an enviable record in regular steel mill service. Among our customers are Inland Steel Co., Illinois Steel Co., American Sheet & Tin Plate Co., American Steel & Wire Co., Wisconsin Steel Co., Tennessee Coal, Iron & R. R. Co., Carnegie Steel Co., Acme Steel Co., Jones & Laughlin Co., Keystone Steel & Wire, and others. Let Whiting engineers work on your next crane problem.

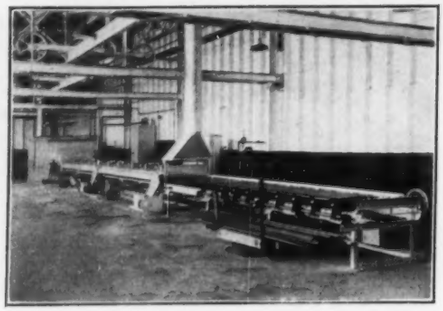
General Crane Catalog No. 214 on request

WHITING CORPORATION + HARVEY, ILLINOIS

THIS IS OUR FIFTY-FIRST YEAR

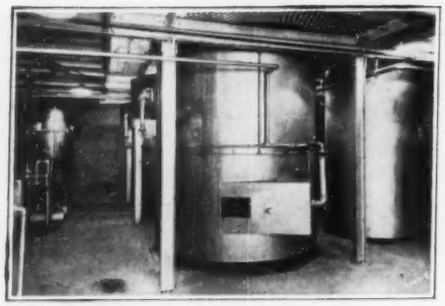
WHITING

STEEL MILL CRANES



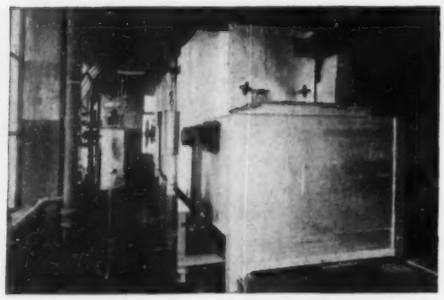
Bright Annealing Steel Tubing

Cold drawn seamless steel tubing in various lengths and sizes is bright annealed continuously in this controlled atmosphere conveyor type furnace. The Elfurno generator for furnishing the special atmosphere used is shown in the background. This furnace has capacity for bright annealing or normalizing 40,000 pounds tubing per day—can be built in larger or smaller sizes to fit customer's specific requirements.



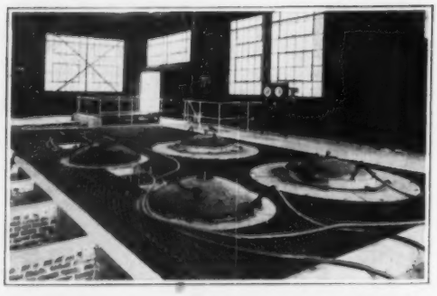
Bright Annealing Steel Wire

The illustration at left shows two pit type furnaces with Elfurno gas generator for annealing steel wire in coils. Advantages include: increased tonnage per pit, improved fuel economy, more uniformly annealed wire, lower maintenance cost, decreased annealing time and labor requirements, and maximum flexibility—will produce bright surface, semi-bright or otherwise as required.



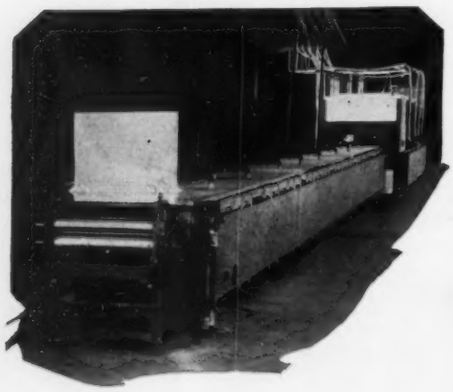
Scale-free Heat-Treating Bolts, Etc.

The rugged, dependable, continuous chain belt conveyor type furnaces which we have been building for the past seven years are now being designed for use with special atmosphere for scale-free heat treating and clean and bright hardening miscellaneous products. They produce a superior product at no appreciable increase in cost. A furnace for clean and bright hardening bolts is shown at left.



Normalizing and Spheroidizing Rod

Fuel fired pit furnaces of the type shown at left and above have also been developed for clean normalizing and spheroidizing rod as well as the annealing of low carbon steel wire in coils. Low operating and maintenance cost, greater uniformity and ease of handling are some of the advantages of these fuel fired pits—they can be either gas or oil fired.



Bright Annealing Strip--Continuously

Cold rolled steel strip is bright annealed continuously in the furnace shown at left. The finish is uniformly bright and the anneal absolutely uniform. Other advantages include lower operating cost, elimination of pickling, and less material in process as the anneal is secured in a few minutes in place of hours.

We specialize on building electric and fuel fired equipment to fit the customer's specific requirements. Our engineers will be glad to work with you on your problems.

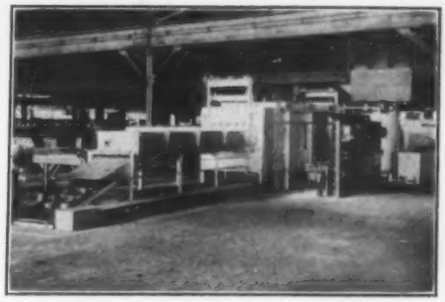
THE ELECTRIC FURNACE CO.
SALEM, OHIO.

Fuel-Fired Furnaces

Electric Furnaces

Bright Annealing Copper Tubing

One of our continuous controlled atmosphere furnaces for bright annealing copper tubing is shown at right. This furnace handles coils up to 30″ in diameter and straight tubing in lengths up to 35 feet. The material is carried through on a continuous mesh belt conveyor and discharged, bright and dry—ready for shipment. The Elfurno generator for supplying the protective gas atmosphere is shown at right.

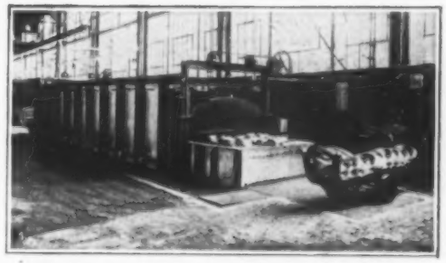


Bright Annealing Copper Wire

The illustration at right shows another type of continuous controlled atmosphere furnace. This furnace is used for bright annealing fine copper wire on spools. No vapor or water seals of any kind are used in this equipment—the wire comes out uniformly annealed, bright and dry ready for shipment or further processing.

Annealing Brass Wire

The continuous, gas-fired, furnace at right was built for a prominent brass and copper company for clean annealing brass and bronze wire in coils. The wire is carried through on a series of continuous alloy chains spaced to carry both small and large coils. The furnace handles 5000 lbs. per hour, and according to the purchaser "produces a high quality, low cost anneal with very good finish".



Annealing Strip in Coils

Coiled strip in various widths is annealed in this double chamber, return recuperative type furnace. The coils are charged into the furnace on trays and at regular intervals are automatically pushed through the recuperative chamber, into and across the heating chamber, and back through the recuperative chamber—the heat from the outgoing line preheats the ingoing material—saves fuel.

Annealing Alloy Steel Bars and Rod

The upright pit type furnace shown at right was installed several years ago in a prominent steel plant for spheroidizing and annealing alloy bars and rod. This furnace has self-contained motor operated cover lifting device, six controlled heating zones, and handles material up to 27′ in length.

We build furnaces for every heating and heat treating process, for any product or production. No job is too large or too unusual. We solicit your inquiries.

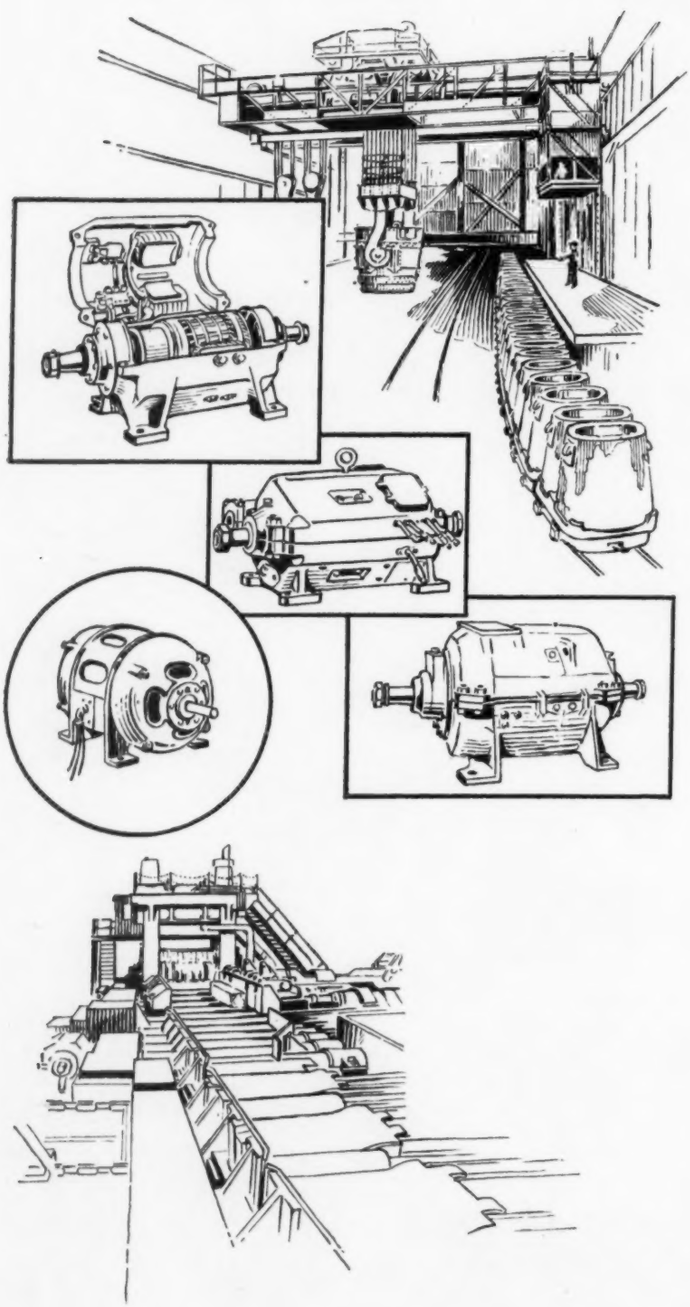
THE ELECTRIC FURNACE CO.
SALEM, OHIO.

Fuel-Fired Furnaces

Electric Furnaces

HYATT

In the Operating Equipment



The following manufacturers of steel mill equipment regularly employ Hyatt Roller Bearings in their production or can furnish Hyatts in their equipment upon specification:

Mesta Machine Co.
Morgan Engineering Co.
Alliance Machine Co.
Aetna-Standard Engineering Co.
Cleveland Crane & Engineering Co.
Harnischfeger Corp.
Whiting Corp.
Shaw-Box Crane & Hoist Co.
Pittsburgh Steel Fdry. Co.
Continental Roll & Steel Fdry. Corp.
Lewis Foundry & Machinery Co.
Treadwell Engineering Co.
Birdsboro Steel Fdry. & Machine Co.
Hillyard-Newbold Co.
Pennsylvania Engineering Co.
International Clay Machy. Co.
Wellman Engineering Co.
E. W. Bliss Co.
Morgan Construction Co.
Shepard-Niles Crane & Hoist Corp.
Westinghouse Electric & Mfg. Co.
General Electric Co.
Crocker-Wheeler Electric Mfg. Co.
Diehl Electric Mfg. Co.
Reliance Electric & Engr. Co.
Atlas Car & Mfg. Co.
Hardie-Tynes Mfg. Co.
Mackintosh-Hemphill Co.
Arthur G. McKee Co.
Wm. B. Pollock Co.
Koppel Industrial Car & Equip. Co.
Surface Combustion Corp.
United Engineering & Fdry. Co.
—and others.

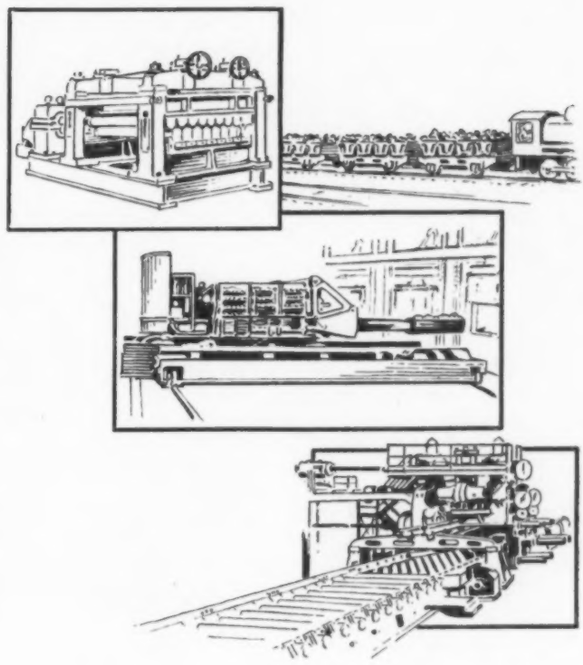
is serving
of Practically Every Steel Mill

Wherever Hyatt Roller Bearings serve they save too, and that is why they are so universally employed in steel mill service.

They save wear and tear on the equipment and help give it longer life. They save lubricant and the time necessary to apply it. And because they substitute true rolling motion for sliding friction, they effect considerable power saving.

The countless thousands of Hyatt Roller Bearings which for years have served in steel mills are advance proof of how well and how long the new thousands will carry on.

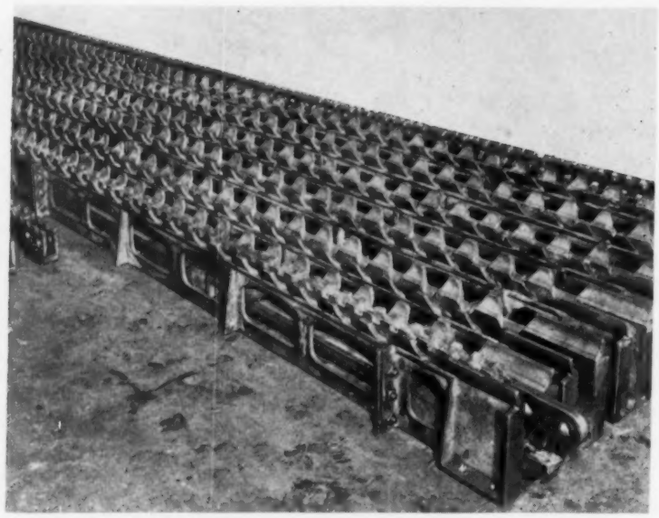
Tables and cars—cranes and motors—equipment of every description — with Hyatt Roller Bearings as an integral part is your assurance of more efficient and economical operation. Play safe and specify these better bearings. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, San Francisco.



H Y A T T

ROLLER BEARINGS

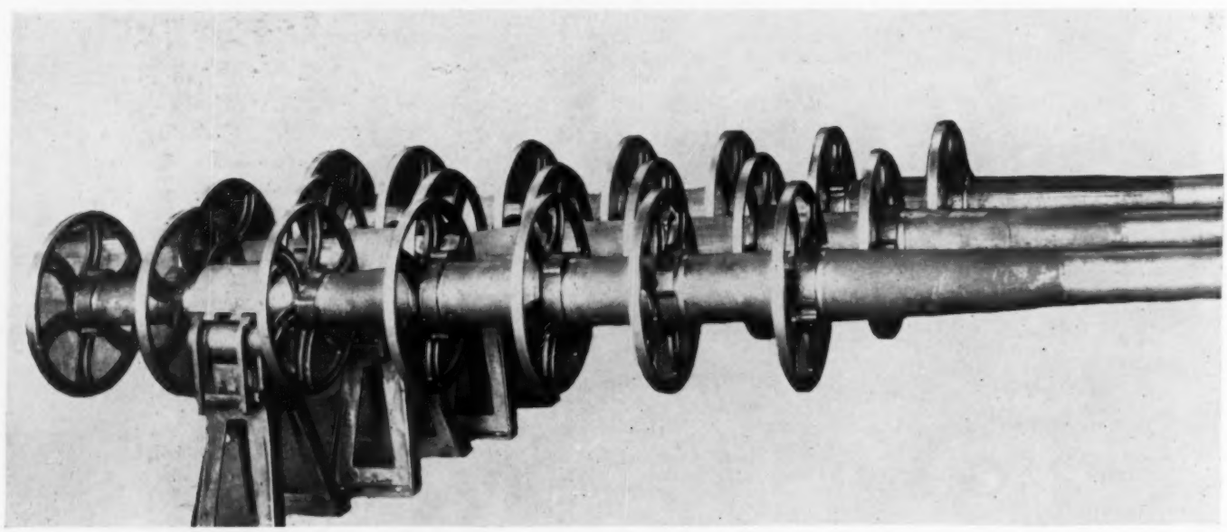
PRODUCT OF GENERAL MOTORS



Walking Beam Rails made of the alloy, "Cimet"

What do you use?

Normalizing Shafts...
Walking Beam Parts...
Chain Blades...



Blythe Roller-bearing normalizing shafts made of the alloy, "Cimet" for a prominent Steel Company

To get the utmost in satisfaction from normalizing shafts, walking beam parts, chain blades, etc., send your specifications to the oldest and largest manufacturer of heat and corrosion resisting castings.

Driver-Harris Company has been making alloy castings for heat and corrosion resisting purposes for more than twenty years. During that time, we have made castings weighing from 1 oz. to 13,000 lbs. each, specializing in precision castings that bring precision results.

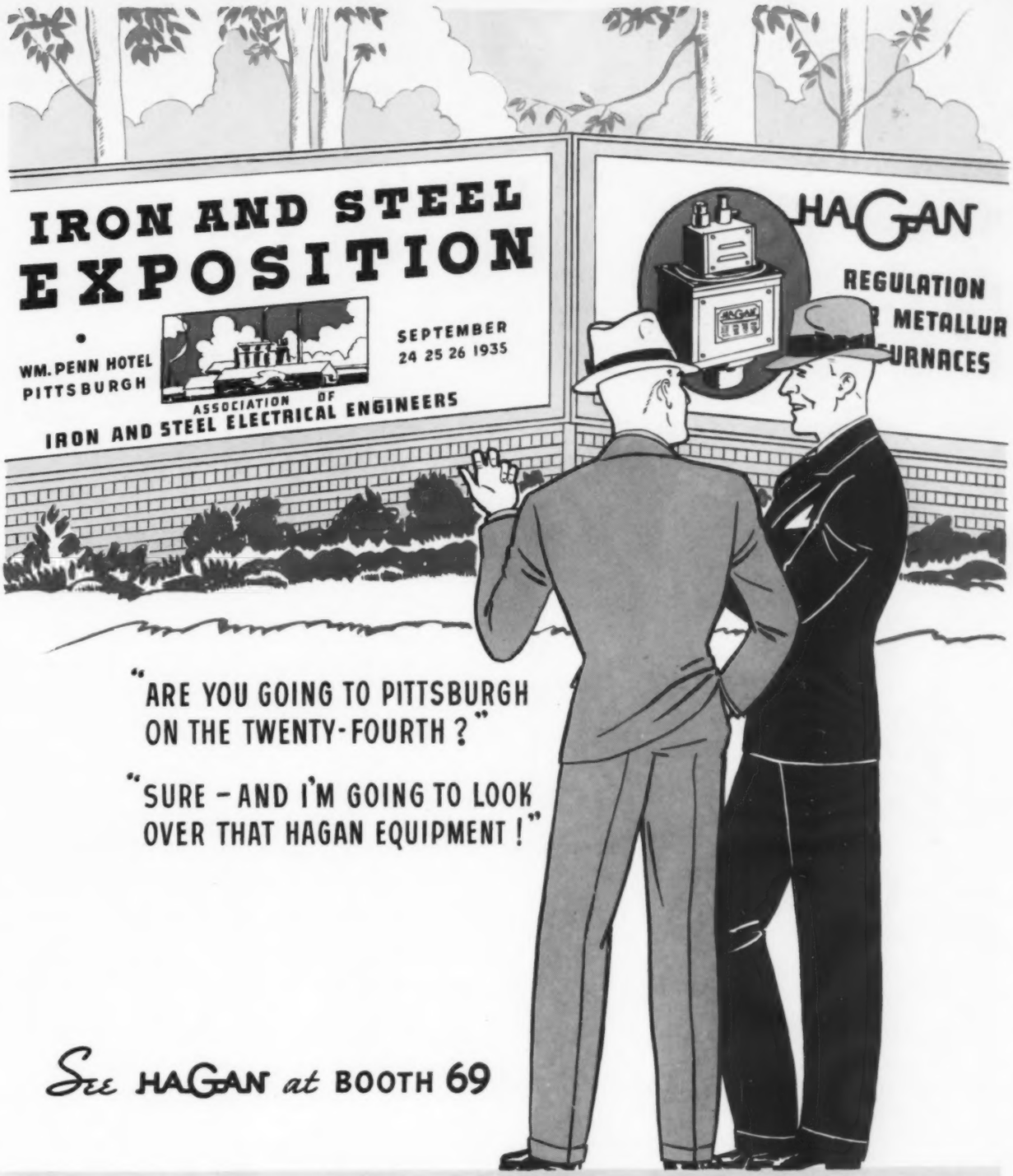
Why not investigate "Nichrome", "Chromax" or "Cimet" roller-bearing normalizing shafts,* walking beam parts or chain blades...whatever you use we can meet your specifications.

*Covered by U. S. Pat. Nos. Re 19,205—1,992,466—1,992,467

DRIVER-HARRIS COMPANY

HARRISON, N. J.

Chicago - Detroit - Morristown, N. J. - England - France
Cleveland Italy



HAGAN AUTOMATIC CONTROL

Open Hearth Draft Control
Heating Furnace Draft Control
Soaking Pit Draft Control
Constant Gas or Air Pressure Control
Air-Fuel Ratio Control
Gas Mixing Control
Blast Furnace Gas Burner Control
Gas Bleeder Control
Coke Oven Collecting Main Pressure Regulation
Coke Oven Fuel Gas Pressure Regulation
Coke Oven Stack Draft Control
Coke Oven Exhauster Control
Boiler Combustion Control
Boiler Draft Control
Auxiliary Turbine Speed Control
Feed Water Heater Temperature Control

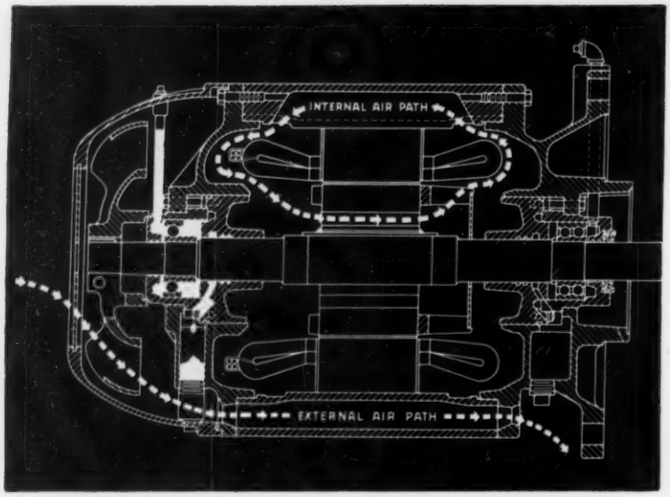
HAGAN CORPORATION

PITTSBURGH. PA.

ADVERTISEMENT 6-R

HERE'S WHY

This Roll Table Motor REQUIRES MINIMUM MAINTENANCE



Cross Section of Roll Table Motor showing patented bearing construction, dual ventilating system and rigid cast frame construction.

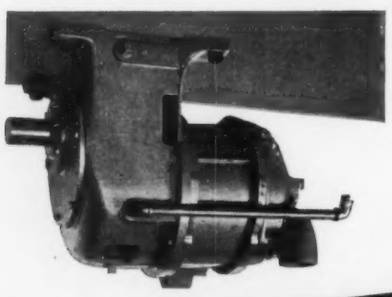
Take a good look at this cross-section drawing of the Westinghouse Roll Table Motor. You'll see why it stays on the job day in and day out—free from maintenance expense. Note particularly:

Self-Cleaning Bearings—You rarely, if ever, have to clean these special anti-friction bearings. Fresh grease is introduced to their surfaces in such a way as to force out old and surplus lubricant ahead of it. In no other roll table motor will you find this patented system that cuts bearing maintenance so effectively.

Dual Ventilation—External and internal air paths in adjacent ducts keep the motor extremely cool. High air velocity prevents clogging.

Rigid Cast Frame—Assures permanent and accurate alignment of bearings and gears.

Westinghouse Dual Ventilated Fan Cooled Motor for Flange Mounting on Roll Table Gear Box.



Westinghouse Dual Ventilated Fan Cooled Gearmotor for Roll Table Drive.

★

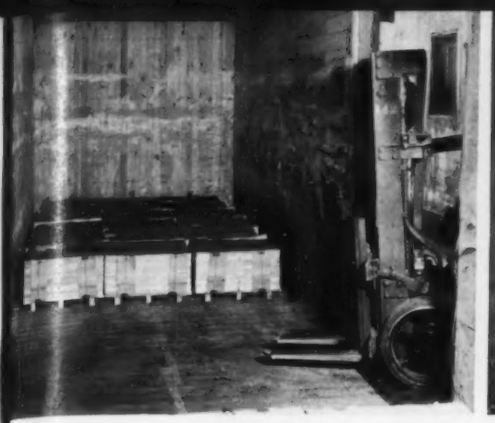
A CORDIAL INVITATION

We invite you to see the roll table motor and various Westinghouse electrical apparatus at the Iron and Steel Show. Discuss your problems with our engineers. Make our exhibit your headquarters.

Ask for complete information. Call or write the nearest Westinghouse Office.

R 52131

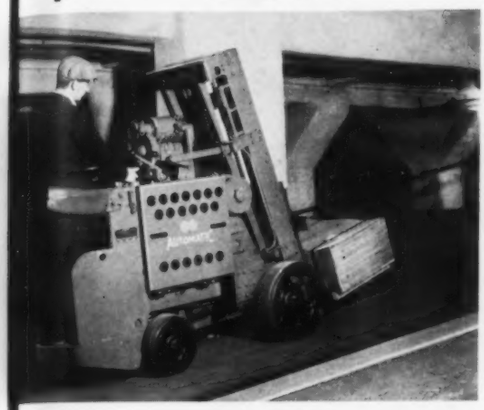
Westinghouse



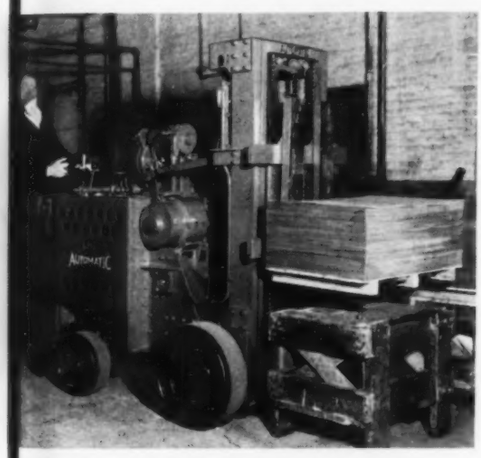
1 *Entering box car*

2 *Negotiating narrow car door in one swing by means of rear wheel steer and front wheel drive*

3 *Breaking out car. Note removal of tin plate bundle from first row corner*



4 *Climbing steep ramp to storage with load tilted.*



5 *Placing bundles on feeder tables*

6 *Stacking five bundles high in storage. Collapsed height of 80" provides 99" total lift*

● *High speed of travel and lift a feature.*

MODERN TIN PLATE HANDLING ··· *with* "AUTOMATIC"

FRONT WHEEL DRIVE – TELESCOPIC TILTING FORK TRUCK

● *This model available in capacities from 1,750 lbs. to 7,000 lbs. equipped with forks of proper length to suit requirements.*

SEE NEW "AUTOMATIC" FORK TRUCK EXHIBIT BOOTH 4

"AUTOMATIC" Tilting FORK TRUCKS make it possible to load, unload, transport and stack tin plate, as well as the products made of tin plate, speedily, efficiently and economically.

This front wheel drive "AUTOMATIC" affords a most modern and dependable truck for a wide variety of industries because it can be adapted to all phases of raw and finished material handling by means of the pallet system. Scoops can be installed for handling rolls of paper; chisel nose forks for baled paper, pulp, or cotton; special forks and pallets for bagged sugar, flour, salt, grain, etc.; dump bucket for loading and unloading bulk products; rams for reels of wire; straddle forks for pig lead, bar copper, etc.; special thin forks for crated refrigerators, crated stoves; clamp forks for barrel handling. Canned goods in cartons, case goods, crated products, all can be handled in unit loads and stacked to ceiling height with inexpensive pallets and this versatile machine.

AUTOMATIC TRANSPORTATION COMPANY

DIVISION OF THE YALE & TOWNE MANUFACTURING CO.

47 WEST 87th STREET CHICAGO, ILLINOIS

Speed the flow of materials, increase the load-per-trip and miles-per-hour, reduce your handling costs, eliminate costly maintenance—do it with "AUTOMATIC." Write for details.

Elevating Platform Trucks
High Lift Trucks
Telescopic Trucks
Tilting Fork Trucks
Tractors
Locomotive Crane Trucks
Die Handlers
Ram Trucks
Bosh Trucks
Roll Handlers
Reel Handlers
Furnace Chargers
Load Platform Trucks
Baggage Trucks
Sheet Handlers
Container Trucks
Special Crane Trucks
Sugar Crushers
Tin Plate Trucks
Hopper Trucks

AVAILABLE IN CAPACITIES UP TO 50 TONS

TRADE **AUTOMATIC** MARK

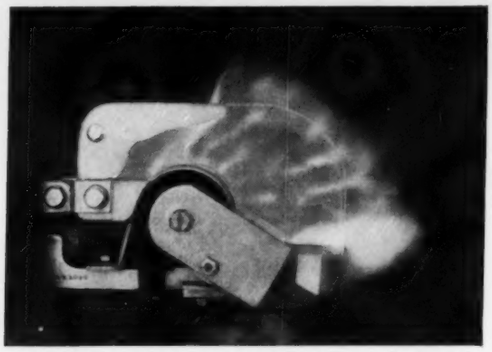
Electric

MATERIAL HANDLING EQUIPMENT

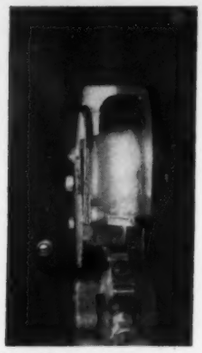
• ***THE REASON FOR LOW COST TRANSPORTATION*** •

Announcing The EC&M

The Arc is ruptured in a narrow line, centered midway between the arc shields.

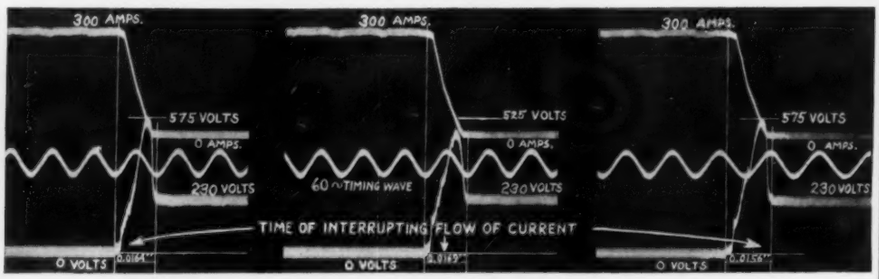


LINE-ARC Contactor, specially fitted with Glass Arc Shields to demonstrate *LINE-ARC* principle. Glass neither smudged nor harmed in this test.



LINE-ARC Contactor with one arc shield cut away, showing the magnetic centering of the arc by *LINE-ARC* principle.

Here's the Result of LINE-ARC Action



Oscillograph curve of *LINE-ARC* Contactor rupturing 300% Load. The current curve is a smooth, straight line from maximum to zero value. There is no restriking of the arc and but one smooth, rounded voltage peak across the contacts as the circuit is opened. The time of rupturing is consistent and of short duration.

The Arc...Now SCIENTIFICALLY CONTROLLED by the LINE-ARC Principle . . . a remarkable new discovery in contactor design . . .

EC&M introduces a complete new line of alternating and direct current contactors which embody a startling new method (LINE-ARC) of handling the arc so that the arc is a line, centered midway between the arc shields.

As the contacts of these new LINE-ARC contactors start to separate, the arc is immediately removed from the contact tips, one end traveling rapidly up along the circular copper guard over the blow-out coil and the other end traveling outward and in the opposite direction along the horizontal copper arcing-plate located between the arc shields. The arc is not allowed to play around on local areas, but is kept moving at high speed, being stretched out in a line midway between the arc shields until it is ruptured.

Since the arc is instantly removed from the contact tips, the contacts remain cool and under normal conditions they never even reach the temperature of electronic emission (a condition in which the temperature of the arc-handling-surface is raised, by the heat of the arc, to the point where electrons are fed into the arc stream, making the path of the arc a better conductor and more difficult to rupture). The contact life of these new EC&M LINE-ARC contactors has been increased far beyond any previous conception. There is no consumption of metal from the arcing-plate and blow-out-guard, because of the constantly changing terminals of the arc and the speed at which the arc is stretched out along these parts. Therefore, they should last indefinitely.

This LINE-ARC design causes the arc to break clean. By moving the arc at a high speed and eliminating the emission of electrons into the arc stream, there is no re-striking of the arc with its succession of rapidly occurring sharp voltage peaks to strain the insulation of connected apparatus. Instead, there is only one moderate and rounded voltage peak across the contacts as the arc is ruptured. This is clearly illustrated in the above oscillograph curve. Also, note that the current curve is a straight line from maximum to zero value; there has been no electronic emission in rupturing the circuit during these three tests. Let us demonstrate these facts to you at the Iron & Steel Exposition.

E&M

EXAMINE, TEST & OPERATE

THESE NEW CONTACTORS

At Booth Nos. 34 & 35. Iron & Steel Exposition

WM. PENN HOTEL, PITTSBURGH, PA., SEPT. 24, 25 & 26

LINE-ARC in Appearance - - - -

COMPLETE NEW LINE of LINE-ARC CONTACTORS

FOR

Mill, Crane and Machinery Controllers... Welding Machines and other A. C. and D. C. Applications

UTTERLY different in design . . . far advanced in the materials and construction used, these new EC&M LINE-ARC magnetic contactors can not help but set amazingly new performance records. They are outstandingly new in every respect, setting entirely new standards of

1. Handling of the Arc.
2. Quickness of response.
3. High speed operation.
4. Hardness of Contacts.
5. Life of Bearings, Shunts and all mechanical parts.
6. Elimination of bounce when closing or opening.
7. Arc rupturing ability.

Alloy Frames, Rolled Steel Cores

The frames and contact arms of these new contactors are made of a strong aluminum alloy, having the advantage of light weight and low inertia of moving parts which permits extremely quick response and high speed operation. The armature and core of the direct current Type LT Contactor are made from rolled steel parts and from high grade electrical sheets for the alternating current Type LTZ Contactor. Operating coils are form wound, insulated between layers and impregnated to make them moisture-proof. Coils are wound for continuous duty for all A. C. voltages and for all D. C. voltages, 230 volts or less.

Pure Copper Contacts, Hardened by a New Process

When selecting the contacts for these LINE-ARC contactors, previously accepted methods of cold-forming pure copper into contacts were not good enough. By a new and special process in which the purity and conductivity of copper is not sacrificed, a much harder metal having considerably greater resistance to wear has been secured.

New, Silver, Adjustable Control Circuit Contacts

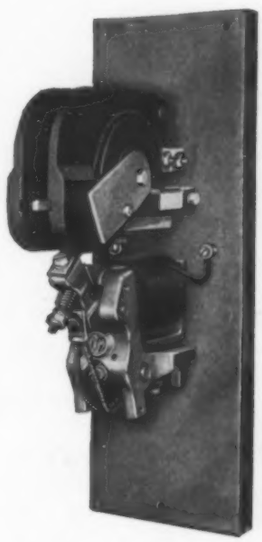
There are no pivots or bearing pins on these new control circuit contacts to wear and cause trouble. The moving contacts, consisting of a metallic, double-break bridge with silver contacts is carried by, and insulated from, the contactor arm. Stationary silver contacts, attached to the panel, are adjustable for contact pressure.

All Parts, Thoroughly Tested and Proved

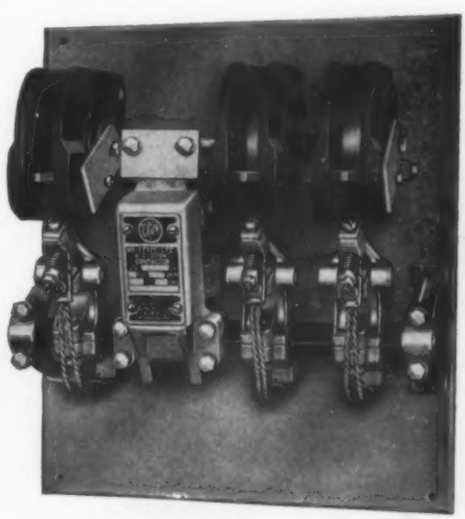
The mechanical and electrical features of LINE-ARC contactors have been undergoing exhaustive tests of many millions of operations under conditions of abnormal current and voltage extending over a period of several years and, while the design is a radical departure from conventional practice, it has been proven at every point and this apparatus is now ready to take its place in any service for which contactors may be required.

A new folder describing and illustrating these contactors has just come off the press. Ask for a copy at booths No. 34 and No. 35 at the Iron & Steel Exposition or write to our nearest district office for complete information.

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND, OHIO



Type LT for Direct Current Service



Type LTZ for Alternating Current

the arc is a line, centered between the arc shields

Visit Booth D – the Ampco Metal Exhibit at the Iron and Steel Exposition

UNDER PRESSURE

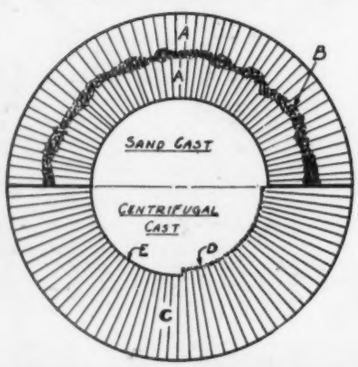
Just as a diver is under pressure at twenty fathoms, so is centrifugally cast metal under pressure during solidification at 1000 or more revolutions per minute.

In centrifugal casting, metal solidifies under the positive outward thrust of centrifugal force. Any impurities or oxides are *forced*, rather than *floated* out of the body of the casting, and the result is a clean, sound piece, far superior to the ordinary sand castings universally produced.

VISIT THE AMPCO DISPLAY

Booth "D" at the Iron and Steel Exposition will contain a representative exhibit of various castings and parts supplied to the Steel Industry. There also will be displayed various specialized alloys produced for individual services.

J. Guy Griffith, the Pittsburgh area Ampco representative, and a member of the Milwaukee organization, will be on hand to offer any desired information relative to the display or special application.



A—Grain growth in a sand cast section where chilling takes place from both inside and outside.
B—The amorphous, weak, structure where the two grain growths meet.
C—Grain growth in centrifugal casting where solidification takes place from the outside inward.
D—Oxide inclusion forced to the inner surface.
E—Clean, close to size surface of the rough bored casting as supplied to the customer.

AMPCO

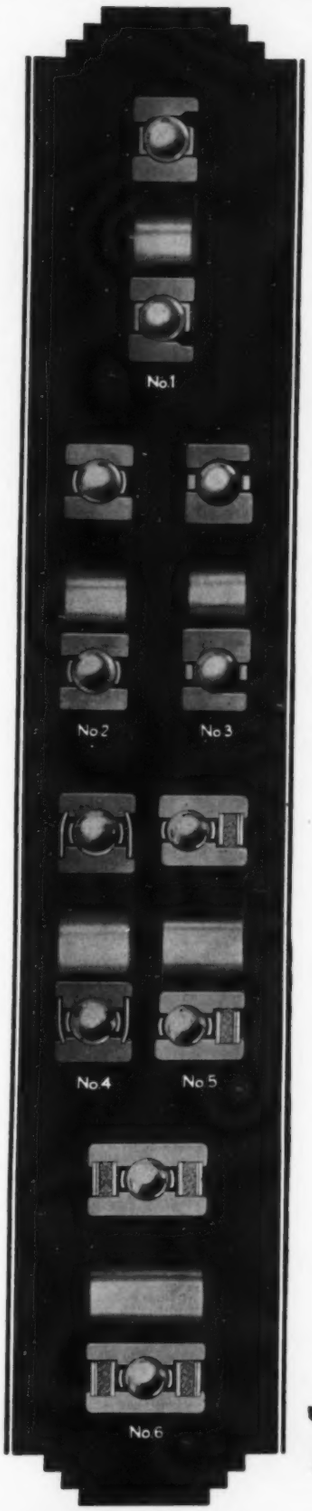
ATLAS TRADE MARK

AMPCO METAL, INC.

MILWAUKEE, WISCONSIN

Visit Booth D – the Ampco Metal Exhibit at the Iron and Steel Exposition

PRECISION



FOR PRODUCTION AT LOWER COST

This is the objective of every executive, engineer and designer; and the performance of the bearings in a production machine is a vital factor in keeping costs down. * * * * But, in comparing bearings, look beyond first cost—look to the ultimate cost over a period of years. Let proved performance point the way to your decision. * * * * For 20-odd years, in every field of industry, **Norma-Hoffmann Precision** Bearings have been making distinguished records for unfailing dependability—records which command the confidence of those who seek the lower production costs that come with the use of better bearings.

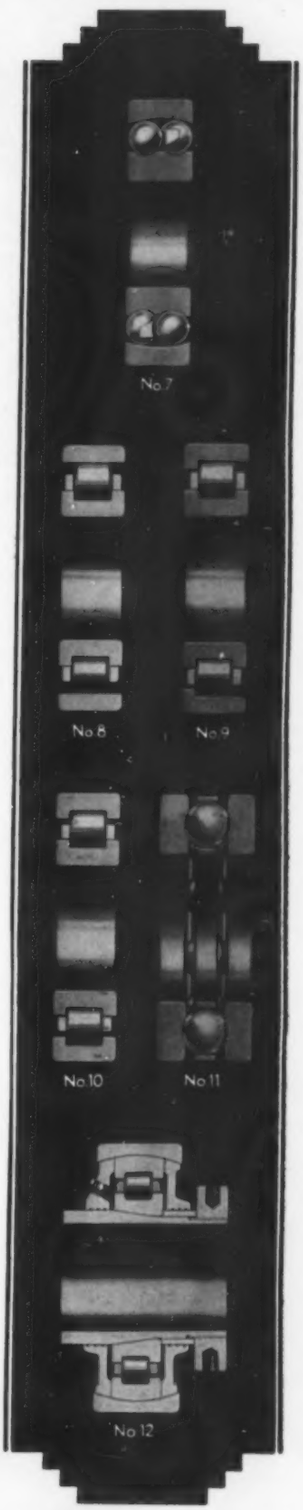
PRECISION BEARINGS
FOR EVERY LOAD, SPEED AND DUTY

No one type of bearing is so versatile in its operating characteristics that it will meet all conditions; conditions should determine the type of bearing used. From the comprehensive **Norma-Hoffmann** line—here illustrated in part and briefly indexed—a **Precision** Bearing, or several in combination, can be chosen that will be exactly right for the duty. Let our engineers, with their specialized experience, work with you in selecting and applying bearings that will lower your production costs. Write for the Catalog.

1—Open (Separable) type ball bearing.
2—Closed, radial type ball bearing.
3—Angular contact ball bearing.
4—Plate (shielded) type ball bearing; available both with one and two grease-retaining, dirt-excluding side plates.
5—"GreaSeal" felt-protected ball bearing with single removable felt seal; available also with single removable felt seal and plate shield, fully enclosed.
6—"GreaSeal" double felt-protected ball bearing, fully enclosed, with double removable felt seal to exclude dirt and retain lubricant.
7—Double-row, self-aligning ball bearing; also furnished with adapter sleeve and nut.
8—Standard cylindrical roller bearing.
9—One-lipped cylindrical roller bearing.
10—Two-lipped cylindrical roller bearing; available also in "full" (cageless) type with retaining rings.
11—Ball thrust bearing.
12—Self-aligning adapter type cylindrical roller bearing, wholly enclosed to exclude dirt and retain lubricant.

NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Conn., U. S. A.

"NORMA-HOFFMANN"



BEARINGS

All Electrical Equipment Placed on Power Circuits Means ECONOMY

Individual Compartments for Connections
Cover broken away to show primary leads in one compartment and the secondary leads in another—both completely covered when installed.

IN your plant there is a real opportunity for saving money on electrical bills.

Where lamps or electrical devices are used at motored machines, connect a Jefferson air-cooled transformer to the "lower rate" higher voltage power line and 110-volt current will be delivered from the transformer for their operation.

Groups of circuits can be supplied with 110-volt current for lamps, soldering irons, drills, any small motor-driven devices, or for remote control circuits.

JEFFERSON Air-Cooled Transformers Will Save Money in Every Plant

In every plant there are these opportunities to save by connecting more of the lighting and small-devices load onto the higher voltage power circuits. The savings will pay for the transformers, the materials, and the installation costs.

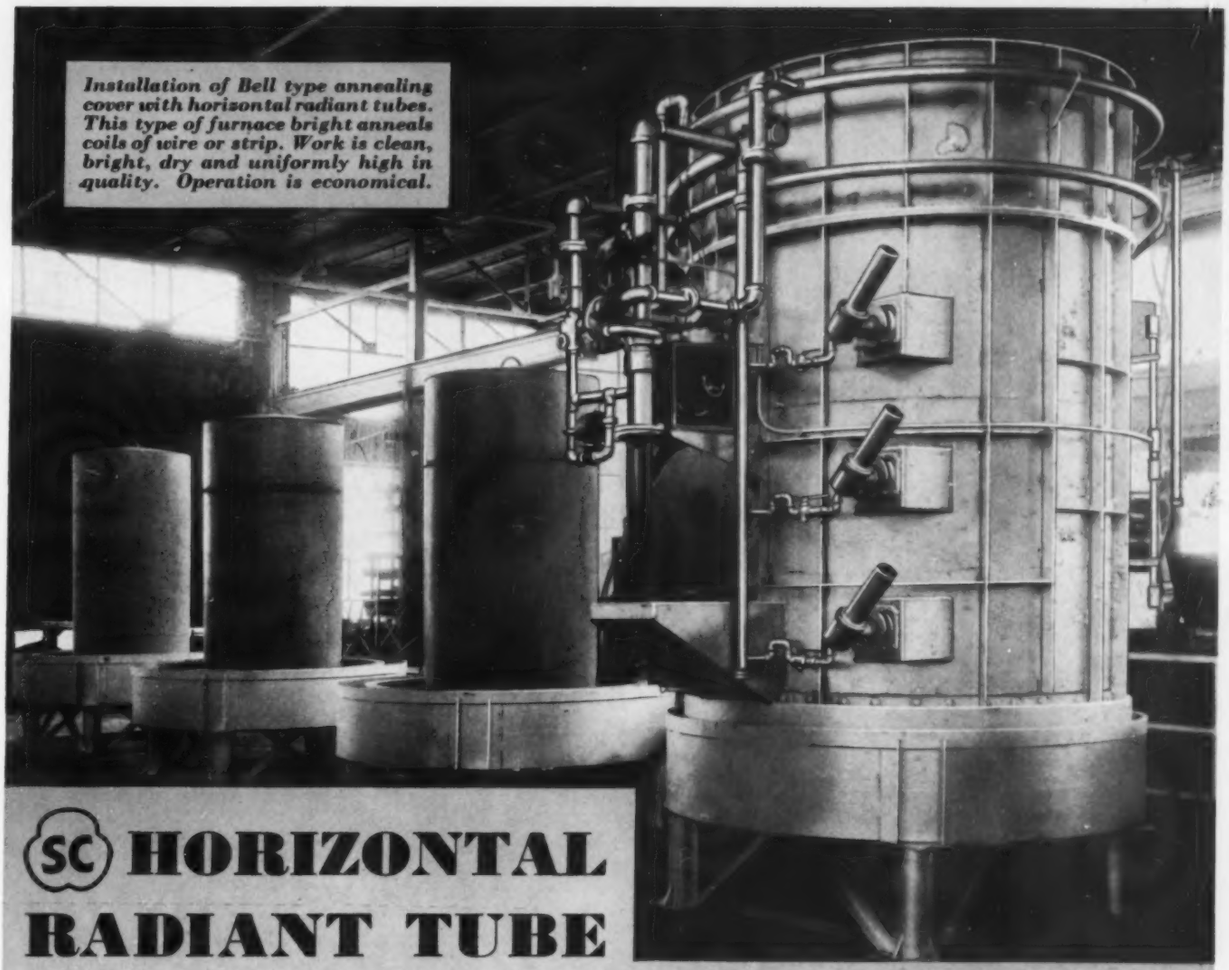
Jefferson air-cooled transformers are listed as standard by Underwriters' Laboratories.

Get our latest pamphlet 341-PCT which gives all the information and data.

JEFFERSON TRANSFORMERS

JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago) Illinois

Canadian Factory: 535 College St., Toronto



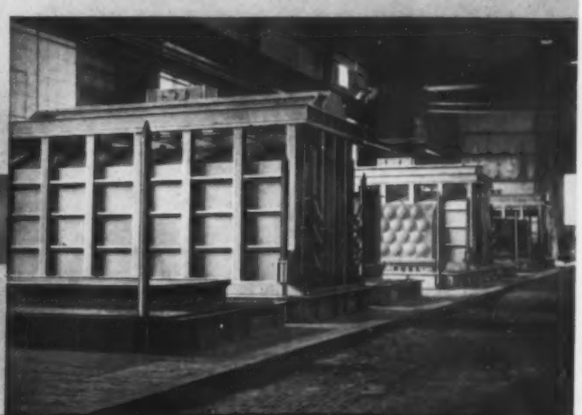
Installation of Bell type annealing cover with horizontal radiant tubes. This type of furnace bright anneals coils of wire or strip. Work is clean, bright, dry and uniformly high in quality. Operation is economical.

(SC) HORIZONTAL RADIANT TUBE ANNEALING COVERS--ROUND OR RECTANGULAR

are the only covers using the Efficient Horizontal Heating elements. These covers are available in a wide range of standard sizes in either rectangular or circular types. Whether annealing tin plate, sheets, wire or strip *they produce more tons of quality annealed material per capital invested.* And these results are produced in actual operation; at a *lower fuel consumption per ton.*

Surface Combustion (SC) Corporation

TOLEDO, OHIO Sales and Engineering Service in Principal Cities



Battery of three SC horizontal Radiant Tube Annealing Covers used with nine bases and six inner covers in large sheet mill. Each cover anneals load of sheets 60" x 186" x 58" high, weighing approximately 150,000 lbs., to a temperature of 1325°F.

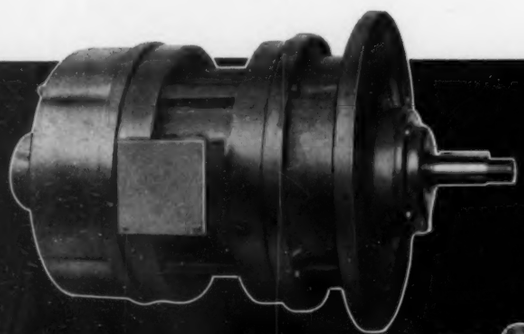
KEEPING IN S

TWENTY-ONE years ago Reliance sought and obtained valuable counsel from steel-mill engineers in the designing of Reliance Type "T" Heavy-duty D-c. Motors. Again, five years later, a generous response was received in connection with the Reliance Type "AA" A-c Motor.

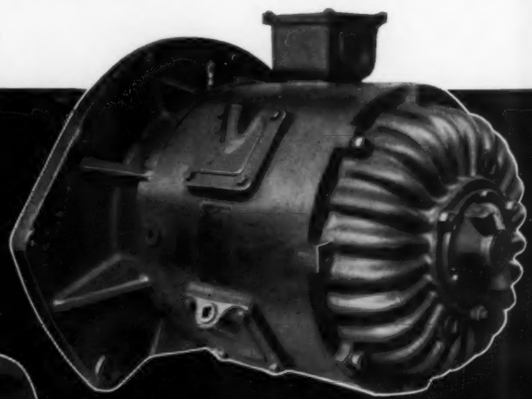
These two instances are but typical of the numerous contacts—of the close, continuous relationship — which the Reliance staff has maintained with current developments in the world of steel. It is through just such windows, kept open all the while through the cooperation of practical steel men, that we have watched the industry move forward and been able to see what it needed and wanted.

Progress in steel making has been paralleled by consistent refinements in the construction of Reliance A-c. and D-c. Motors. In point of strength, in insulation practice, in protection against the external foes of motor life, in the perfecting of new applications to meet new conditions, Reliance has sponsored a steady advance year after year.

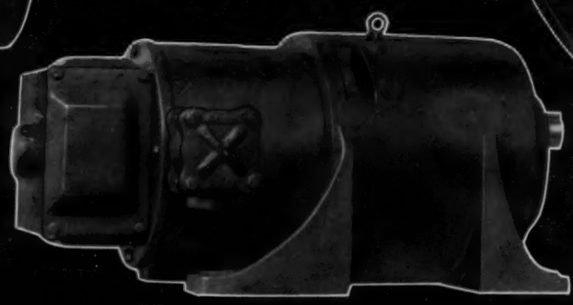
Six representative motors are presented here. Their dependable performance has won for them a wide acceptance in steel mills. They are built to take the inevitable shocks and bumps. They contribute uniformly to the ultimate end of increased output, lower operating and maintenance costs, and better steel. Reliance Motors are paying investments.



Below—Reliance Gear Motor with dust-tight D-c. motor unit. Furnished also with A-c. power units. Proper support and ample strength are afforded to withstand shocks and pounding. First cost is less and space is saved; installation expense and maintenance are reduced. Available in a variety of types for steel mill use.



Above—Reliance Type "AA" Water-cooled Squirrel-cage Motor with flange mounting for use on coilers on continuous hot strip mills. It supplies evidence of specialized effort on the part of Reliance to produce motors particularly adapted for a definite phase of steel production. It saves weight and space by giving the same horsepower and speed ratings as open motors of the same frame size.



Above—Reliance Type "AA" Dust-tight Squirrel-cage Motor with flange mounting for individual roller drive on run-out tables, designed for variable-speed operation with variable voltage and variable frequency.

Reliance Fully-enclosed Fan-cooled Motors have proved a big aid to preventive maintenance in steel mills. Their thorough-going ruggedness is the first assurance of long service. Furthermore, their fully-enclosed design sets up an effective defense against iron dust, fumes, and water . . . enemies which would otherwise shorten the life of motor windings. Space is conserved, since in most cases the same horsepower and speed ratings are developed as by open motors of the same frame size.

Reliance Fan-cooled Type "T" Heavy-duty D-c. Motors provide the advantages of adjustable speeds with the complete protection of fan-cooled design. A growing demand from steel mills has brought a continuous extension in size range. This type is now available up to 150 h.p. 300 r.p.m.

Reliance Fan-cooled Type "AA" Squirrel-cage A-c Induction Motors aid greatly in the lowering of upkeep. They are available in sizes up to 100 hp. 1200 r.p.m.

Reliance Enclosed Fan-cooled Squirrel-cage Motors as designed for use on roller and catcher tables. These motors were the first of this type built to stand 40 reversals a second.

THE RELIANCE ELECTRIC & ENGINEERING COMPANY

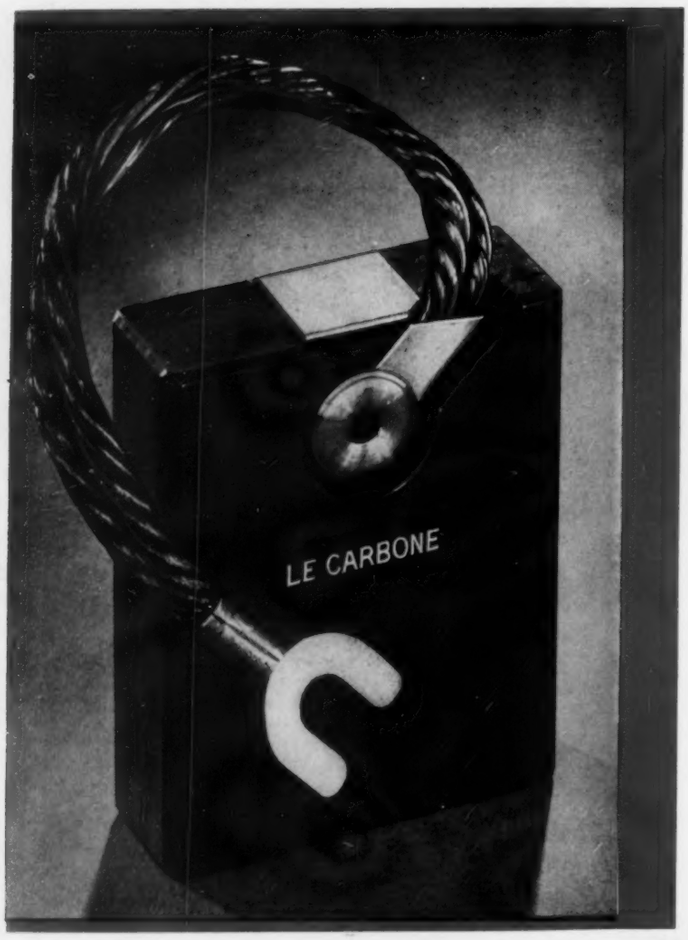
1088 IVANHOE ROAD CLEVELAND, OHIO

Branches: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Detroit, New York, Philadelphia, Pittsburgh
Representatives in other principal cities

RELIANCE A-C D-C MOTORS

★ LE CARBONE BRUSHES....

The choice of experienced operating men, who value dependable performance...



Whether for large capacity, heavy duty steel mill equipment or the smallest auxiliary motor, Le Carbone Brushes have behind them the vast experience of over forty years of continuous laboratory research and development, plus the practical experience gained through many thousands of successful operating applications.

These qualifications allow Le Carbone to meet successfully the ever-changing needs of both operating and designing engineers, and to offer for their use the widest range of brush grades and types available.

LE CARBONE COMPANY

General Offices and Works: Boonton, New Jersey

DISTRICT OFFICES:

Pittsburgh
Box 101, South Hills Sta.

Chicago
53 W. Jackson Blvd.

St. Louis
100 North Broadway

San Francisco
525 Howard Street

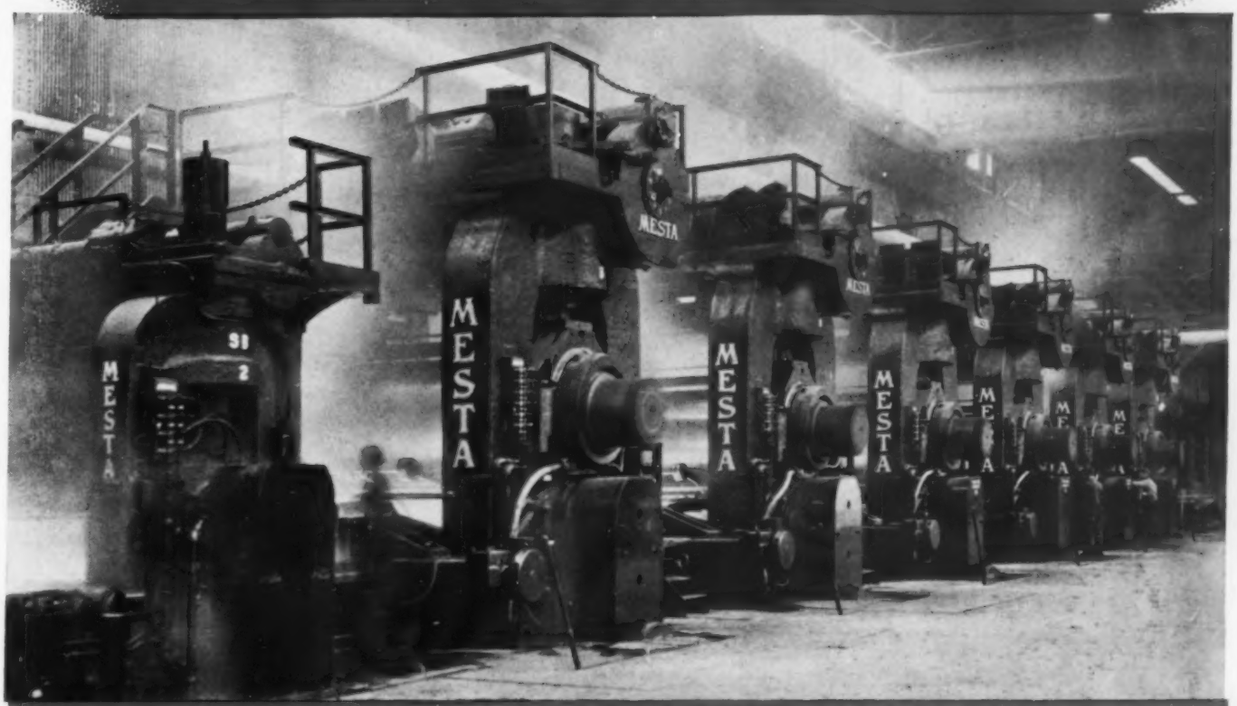
Associated Companies in Argentine, Australia, Belgium, Czecho-Slovakia, England, France, Germany, India, Italy, New Zealand, South Africa, Sweden

★ AT THE IRON & STEEL EXPOSITION

PITTSBURGH, SEPT. 24-26

SPACE 59

72 New Mill Stands in the Past 6 MONTHS



79" Continuous Hot Strip Mill at The Youngstown Sheet & Tube Company

FARVAL has been selected for Roll Neck lubrication on 72 new Mill Stands in the past 6 months alone.

Over **24,275** additional bearings on these new installations are being equipped with Farval to serve Tables, Cranes, and miscellaneous equipment.

This preference is the result of the dependable lubrication provided by Farval over a period of 6 years on more than 200 other Mill Stands.

The 5 largest Strip Mills now in operation are all completely Farval equipped.

The Farval System delivers clean grease under high pressure, in exact measured quantities and at regular intervals, to every bearing. Thus the Farval lubricated bearing is protected in advance against the expense of repair and replacement.

A Farval System can be quickly applied to your existing equipment without interfering with operations.

THE FARVAL CORPORATION
3278 East 80th Street **Cleveland, Ohio**

FARVAL

CENTRALIZED SYSTEM OF LUBRICATION

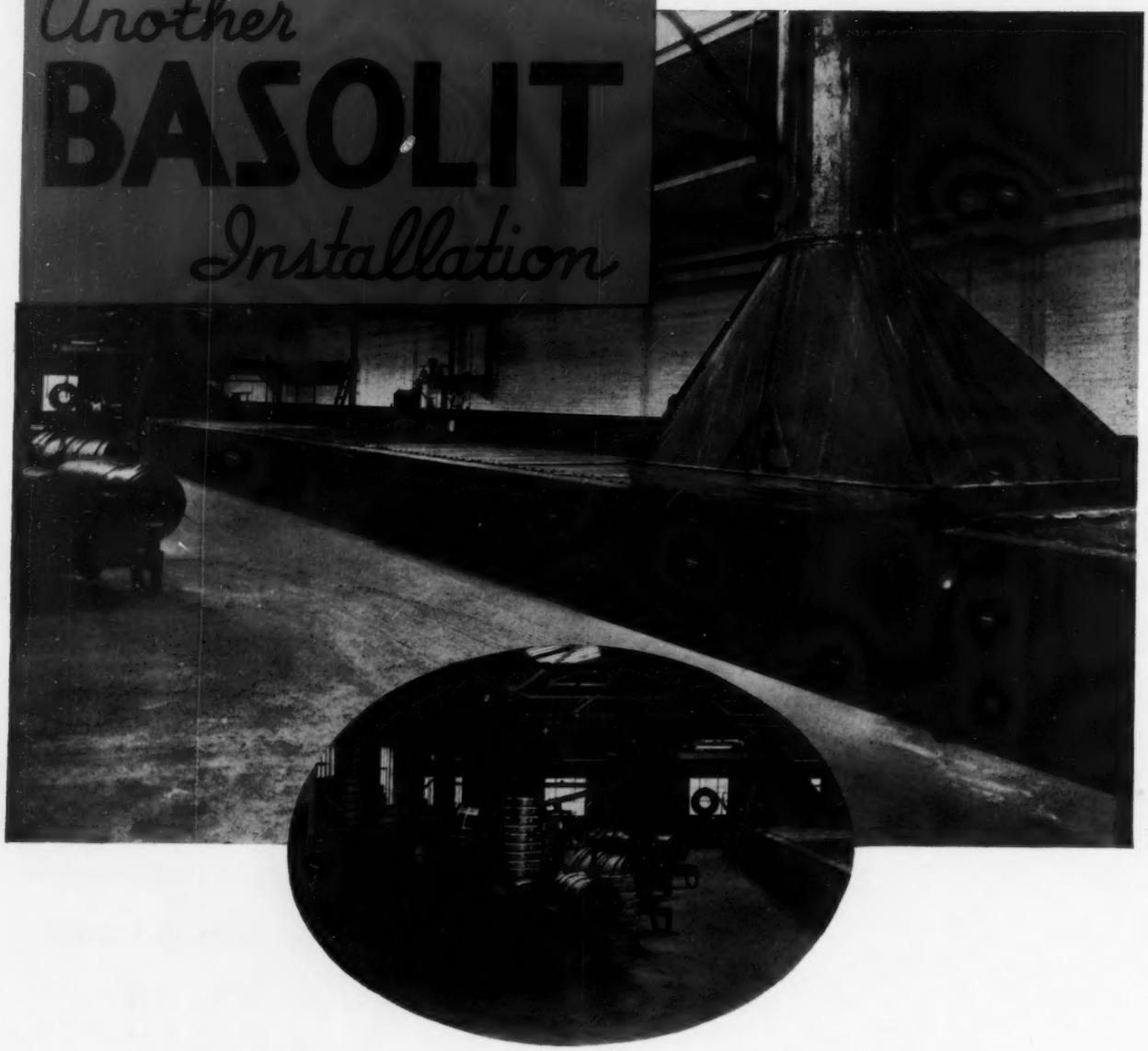
A WORD OF THANKS

May we express our appreciation to our friends in the steel industry who have, in recent months, specified our gears, crane wheels, brake wheels, rolls and similar products for spares, replacements and on their new equipment.

In the recent improvements and additions to steel mills, Cincinnati "Tool Steel" products have been liberally specified. New mills deserve the best of material and equipment. The use of quality "Tool Steel" parts assures years of dependable production, unmarred by troublesome breakdowns and frequent replacements.

THE TOOL STEEL GEAR & PINION CO.
CINCINNATI, OHIO

Another BASOLIT Installation



THIS 100 ft. Basolit Tank installed August, 1933, at the plant of the Wallingford Steel Company is used for continuous pickling of low carbon Strip Steel in hot sulphuric acid solution. In its long, practically uninterrupted service, the tank has been entirely free from leaks and repairs • Basolit Pickling Tanks are immune against all commercial acids. They are an economical solution to many annoying pickling problems—particularly in continuous pickling.

NUKEM PRODUCTS CORP., Buffalo, N.Y.

NEW YORK PITTSBURGH LOS ANGELES TORONTO ONT.

☆ PYLE-NATIONAL

heavy-duty conduit wiring fittings are built for steel mill and other severe types of service. Correct design and unusually substantial construction mean convenient, efficient installation—long life with minimum maintenance—and an assurance of uninterrupted service.

Heavy-duty safety switches, with and without interlocking plug receptacles.
SAFETY SWITCH
PAT APPL'D FOR
ON
OFF
THE PYLE-NATIONAL COMPANY
CHICAGO U.S.A.
Safety portable hand lamps. 48 types to choose from.
"QuelarC" circuit breaking plugs and receptacles. There are other Pyle-National types of heavy-duty plugs and receptacles for all purposes.
These are representative items from the complete Pyle-National line, which includes conduit wiring fittings for all types of heavy-duty industrial applications. Catalogs will be sent upon request.
Cast aluminum alloy and sheet metal floodlight projectors—all types, sizes to 36 inches in diameter.

See the complete display of Pyle-National heavy-duty industrial electrical equipment at the Iron and Steel Exposition, Pittsburgh September 24-26

SPACE 79

PYLE-NATIONAL COMPANY

1334-58 North Kostner Avenue · Chicago, Illinois

Offices at New York, Baltimore, Detroit, St. Louis, St. Paul, San Francisco

OVER 38 YEARS OF EXPERIENCE BUILDING ELECTRICAL EQUIPMENT FOR THE MOST SEVERE TYPES OF SERVICE

NEWS

from the DETROIT DISTRICT

THE most recently purchased wide continuous strip mill—a high-speed, high-quality mill—will meet the requirements of a modern age. **MODERN G-E SWITCHGEAR EQUIPMENT** will be used throughout, including **G-E AIR CIRCUIT BREAKERS** with **SOLID-BLOCK, BRUSHLESS SILVER CONTACTS**—a selection entirely in accord with modern trends.

Brush-type circuit-breaker contacts, like the brush-type facial adornments of the gay nineties, will ultimately become symbols of a passing era

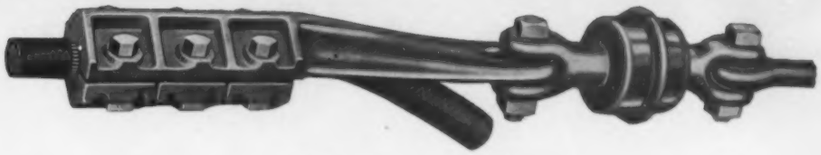
The 6600-volt, heavy-duty switching equipment for the new mill follows the modern trend as well. It is **STEEL**-enclosed **G-E METAL-CLAD SWITCHGEAR** with the famous Type FKR-255 oil-blast breakers—practically the **STEEL INDUSTRY'S STANDARD**—the obvious solution for **STEEL-MILL SERVICE**. General Electric, Schenectady, N. Y.

G. E. Builds with Steel

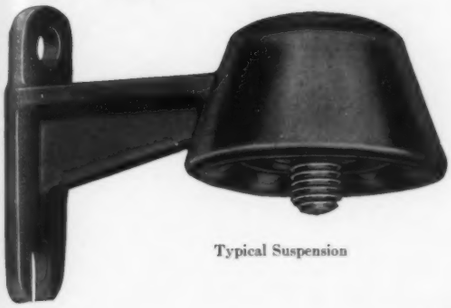
860-7

GENERAL ELECTRIC

Type P Cable
Strain Clamps



Type HW Keystone Cable Strain Clamps



Typical Suspension

Typical Screw Clamp

Keystone Giant Strain Insulator (Porcelain Covered)

Golden Glow
Floodlight Projectors

Keystone Portable
Lamp Guards

We cordially invite you to visit us in Space No. 73, at the Iron and Steel Exposition, Pittsburgh, where we will exhibit many of the products comprising our broad line of Keystone Electrical Equipment.

(Do you have our Catalog No. 10?)

ELECTRIC SERVICE SUPPLIES CO.

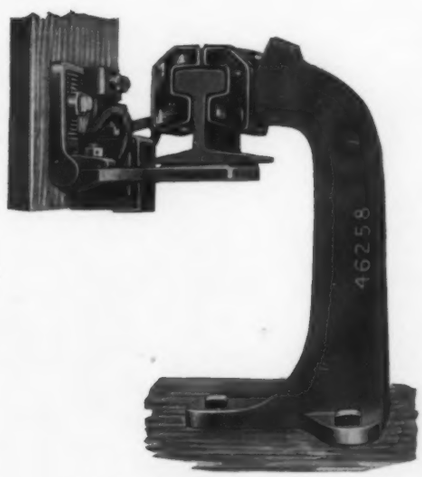
Home Office and plant at 17th and Cambria Sts., PHILADELPHIA; District offices and warehouse at 111 N. Canal St., CHICAGO; 50 Church St., NEW YORK; Investment Bldg., PITTSBURGH; 88 Broad St., Boston; General Motors Bldg., Detroit; Canadian Agents, Lyman Tube and Supply Company, Ltd.

Cass Commutator
Smoothing Stones

Typical Keystone Contact Rail Shoes

Typical Keystone Universal Collector

Typical Assembly Using Keystone
Supporting Bracket



Assembly of Keystone Rail Standard,
Insulator and Shoe

Typical Keystone Universal Collector

THE ROLLWAY BEARING CO. specializes in the manufacture and application of high grade heavy duty straight cylindrical roller bearings. We offer our experience and facilities in your service.

See our Exhibit, Booth 49
Iron and Steel Exposition

Roller bearings for mill motors, cranes, table rolls, strip mills, shears, straightening rolls, furnace and ingot cars, coilers, hot and cold saws, fans. Address: Rollway Bearing Company, Inc., Syracuse, N. Y.

Swartz
AERO-TEX
Tube Cleaner

"Pop's" many friends will be interested to know that he is now taking an active part in the sale of the Swartz Aero-Tex Tube Cleaner of which he is co-inventor.

The Aero-Tex has proven in the eight years it has been on the market to be superior to any other make in power, speed and efficiency.

"Pop" takes pride in recommending this cleaner to his friends and can assure them it will fulfill all claims for performance.

Based on twenty-five years of experience, the Aero-Tex has been designed to greatly reduce the number of necessary parts, and proving in many competitive tests to be the superior of any on the market.

The Motor is rugged and powerful, and the patented E-Z Repair Head is the easiest to repair, having the least number of parts. All parts are made of a special alloy steel, scientifically heat treated.

Descriptive circulars will be sent on request.

THE
D. S. TUCKER COMPANY
MIDLAND BLDG.
CLEVELAND, OHIO

"It Takes
SAND
To Win"

As special representative for N-L Sanders and Lanterns, "Pop" Swartz typifies the N-L Slogan "It takes Sand to Win".

Sand on the rails of your overhead cranes insures safety for your men and eliminates the dangerous practice of riding the end carriage with a bucket of sand.

A surprising number of plants still follow this outmoded practice. Make sure yours is up-to-date on this important safety feature.

Initial cost is comparatively small, prevention of a single fatal accident saves more than their total cost.

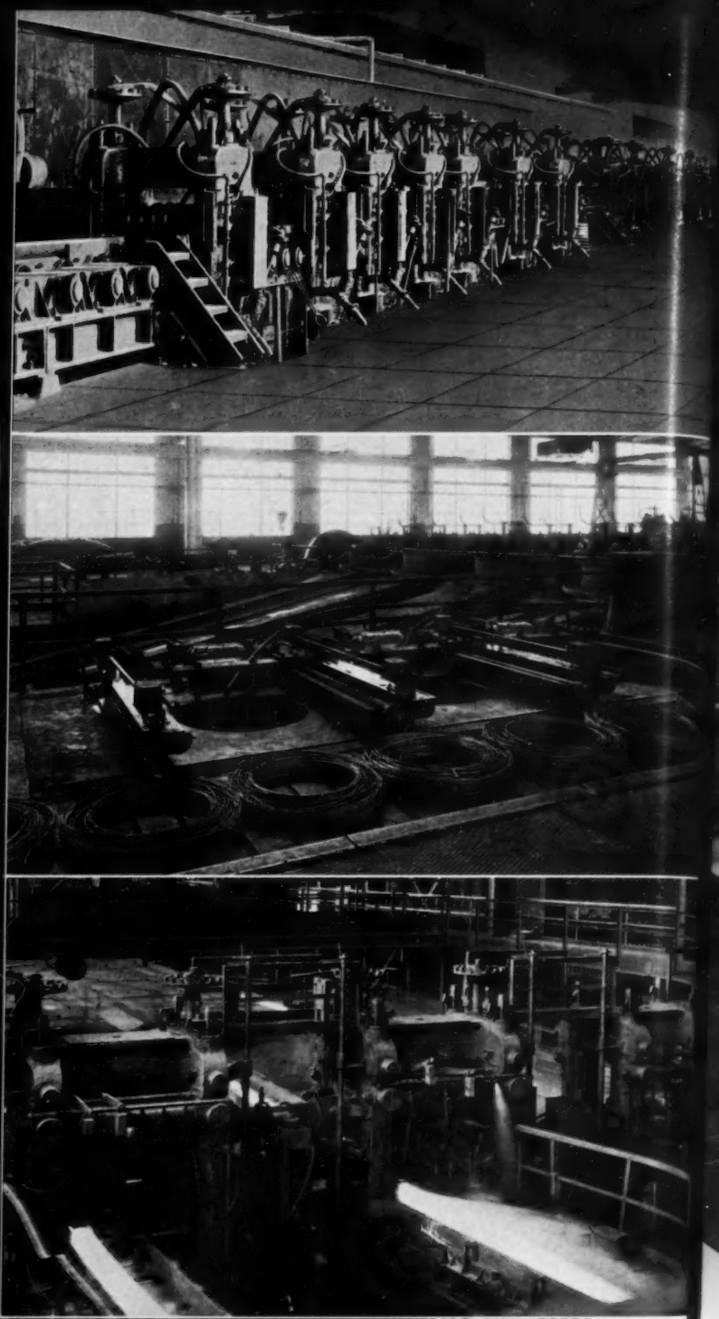
N-L Sanders earn their way in providing smoother, more efficient crane operation. Difficult spotting is made easy, lessened power requirements, increased flange wear and prevention of excessive misalignment are realized when your cranes are N-L equipped.

Write for complete details and prices.

BOOTH No. 74
at the Show

THE NICHOLS-LINTERN CO.
7960 LORAIN AVE. CLEVELAND, O.

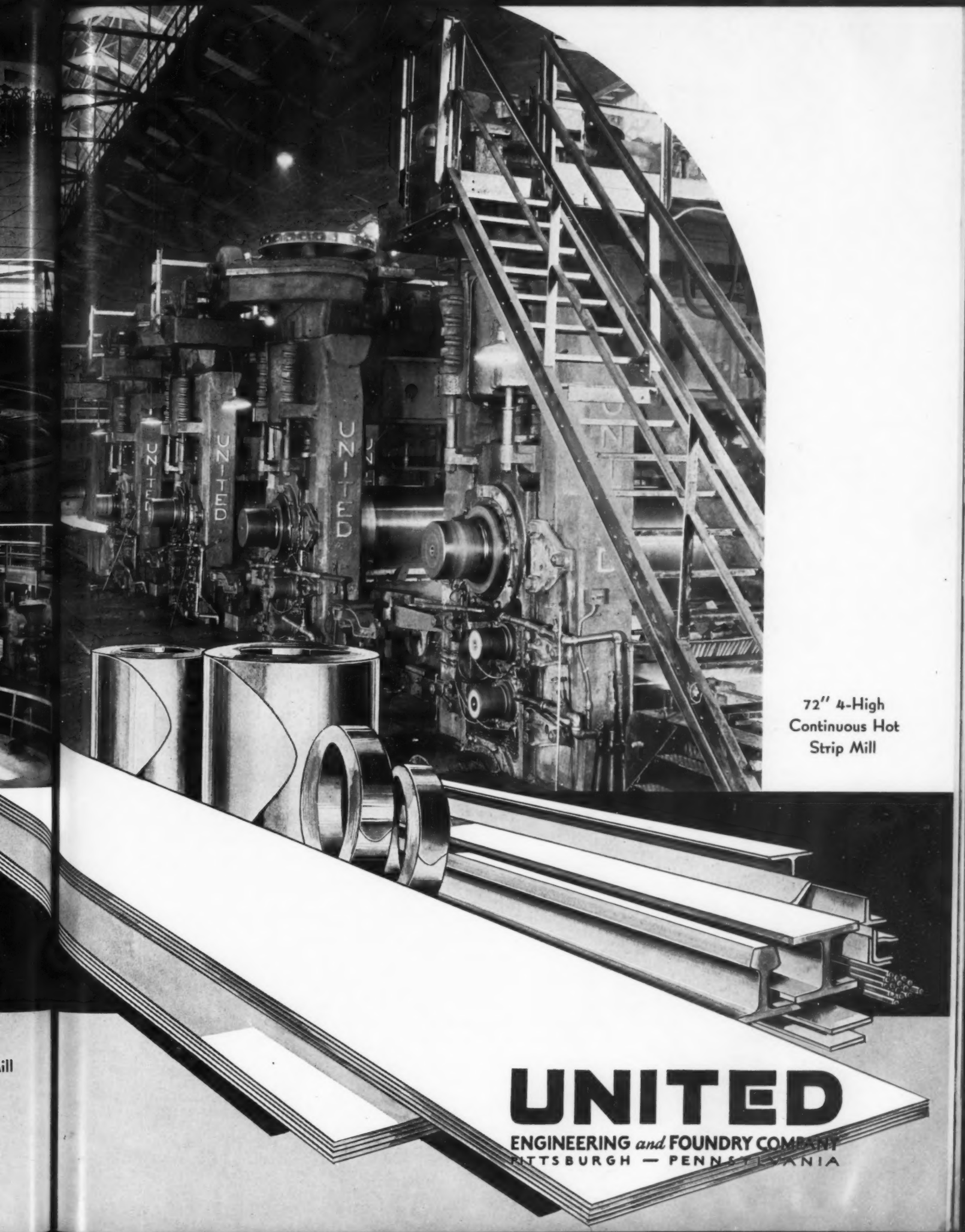
UNITED MILLS *for* ROLLING ALL METALS *of* EVERY SHAPE *and* FORM



Top . . . 10" Continuous Merchant Bar Mill

Center . . . Copper Rod Finishing Mill

Bottom . . . 28" Rail and Structural Mill

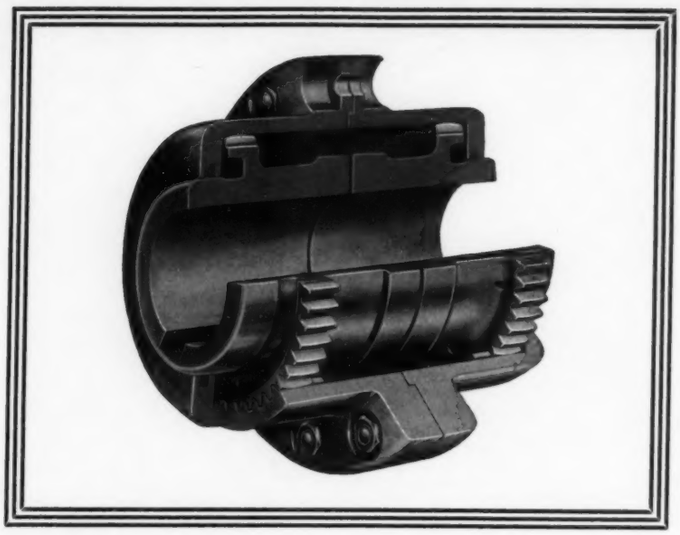


72" 4-High
Continuous Hot
Strip Mill

UNITED

ENGINEERING *and* FOUNDRY COMPANY

PITTSBURGH — PENNSYLVANIA



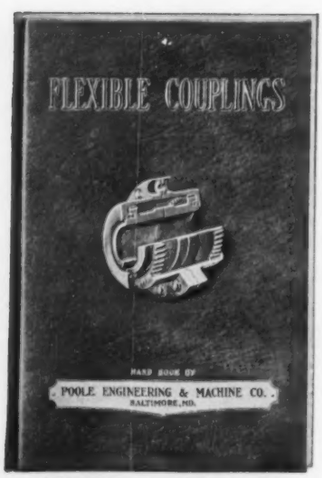
POOLE

can answer your questions with FACTS

No doubt, in your plant, as in thousands of others, many questions arise from time to time as to the merit of the various makes of Flexible Couplings. The best way to answer these questions is to get the facts—then decide.

Our new handbook on Flexible Couplings gives you the FACTS about the various types. It shows the features and improvements which distinguish Poole Flexible Couplings from all others and WHY they are the leaders in their field. These facts should be in the hands of everyone interested in Flexible Couplings.

This handbook also contains valuable data and information needed in selecting the proper coupling.



Write for our Handbook
"FLEXIBLE COUPLINGS"

Poole Foundry & Machine Co.

WOODBERRY, BALTIMORE, MD.

CLEVELAND:
G. H. Bales
231 Rockefeller Bldg.

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549 W. Washington St.

TRUMBULL

FOR THIRTY-FIVE YEARS the Trumbull Electric Manufacturing Company consistently has developed new and improved lines of Switches, with a definite object in view—namely to furnish the steel industry with material of high quality at competitive prices.

●

THE WIDE SCOPE of the products of our company is indicated by the fact that we have for the Steel Mill Engineer of today the most complete assortment, obtainable from any one company in this country, of Enclosed (Safety) Switches, Panel Boards, Power Distribution Boards and other affiliated equipment for complete systems of interior electrical distribution and control.

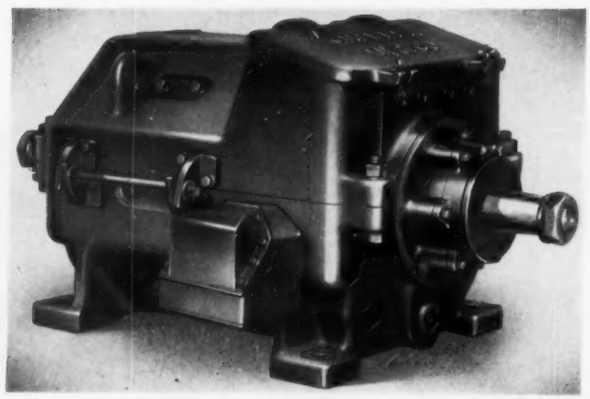
While visiting the Iron and Steel Exposition,
we cordially invite you to
booth No. 6

THE TRUMBULL ELECTRIC MFG. COMPANY

PLAINVILLE CONNECTICUT

A GENERAL ELECTRIC ORGANIZATION

To an industry whose equipment must meet the most severe tests:



The NEW Type S. W. Steel Mill Motor standardized in accordance with recommendations of A. I. S. E. E.

There'll be a NEW Motor at Booth 63, A. I. S. E. E. Convention

New, but born of experience

Back thirty years ago, the first specially designed motor for steel mill use was designed, and built, and delivered by Crocker-Wheeler. Even in those days the iron and steel industry was no place for man or machine inclined to falter on a task. Stamina in both was as essential then as it is essential for equipment of the present day.

The increase in burden since those days has fallen upon the *machine* rather than upon the man.

Of this, Crocker-Wheeler engineers have not only been aware, but fully informed. Frequent consultations with outstanding engineers in the iron and steel industry have kept Crocker-Wheeler engineers promptly informed regarding every change and increase in the severity of operating conditions that must be taken by a steel mill motor.

Thus, this new Type S. W. Steel Mill Motor is as competently designed and built for 1935 operating conditions as was its ancestor for the conditions thirty years ago.

It will meet the most severe tests of the iron and steel industry.

CROCKER-WHEELER

ELECTRIC MANUFACTURING COMPANY

AMPERE, NEW JERSEY

Birmingham	Chicago	Detroit	Philadelphia
Boston	Cincinnati	Houston	Pittsburgh
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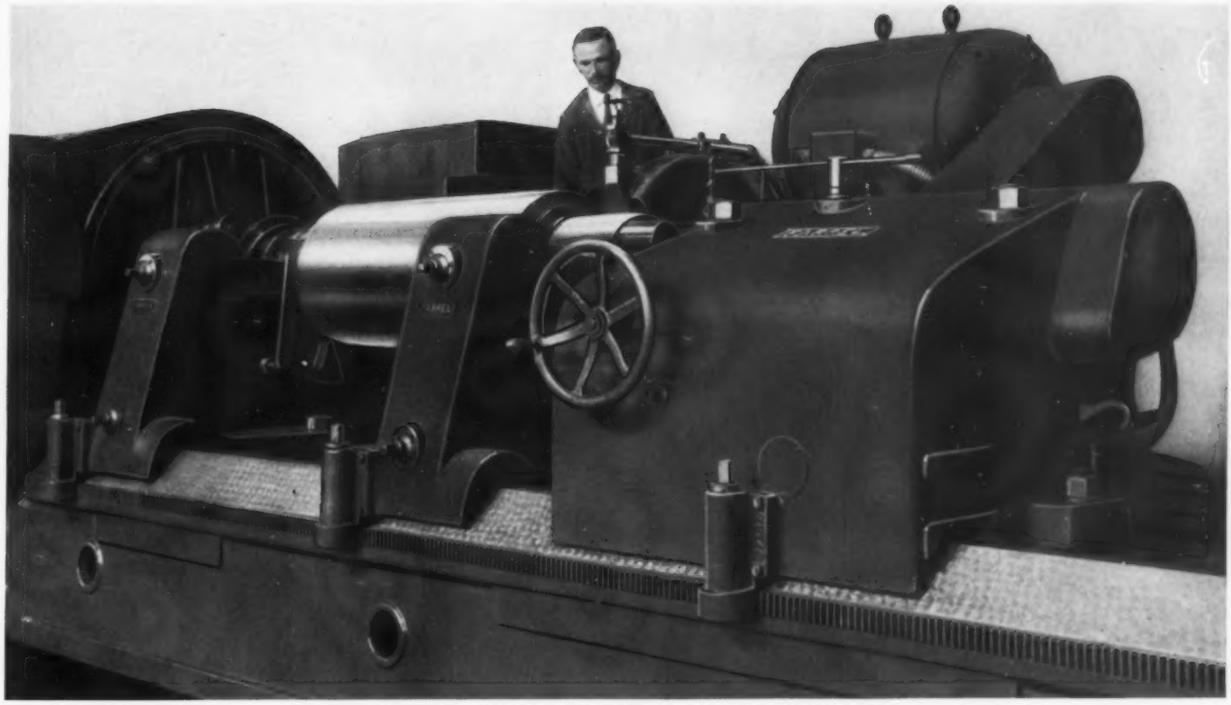
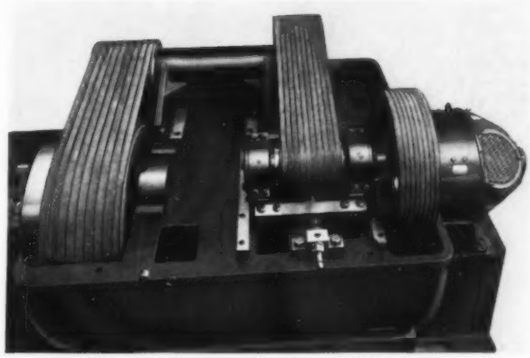
Belted, coupled, direct-connected Alternators in capacities up to 5000 KVA. Motors and Generators in both D.C. and A.C. for every steel mill requirement.



Grinding a roll in a 60" x 20' 0" Farrel Heavy Duty Roll Grinder



The Farrel multi-V-belt headstock drive rotates the roll smoothly, without vibration and without marking.

The Farrel cambering device always produces an accurate and symmetrical crown or concavity.

Higher Accuracy . . . . Better Finish
More Production . . . . . Lower Costs

Rolling mill operators that want to be sure of getting these results in their roll grinding are turning in rapidly increasing numbers to Farrel Heavy Duty Roll Grinders.

The new multi-V-belt driven headstock of Farrel Roll Grinders is the most important development since the introduction of the Farrel automatic cambering device. It completely eliminates vibrations inherent in even the most accurate and carefully mounted gear-driven headstocks and gives results in improved quality and increased output that were previously thought impossible of attainment in any roll grinding machine.

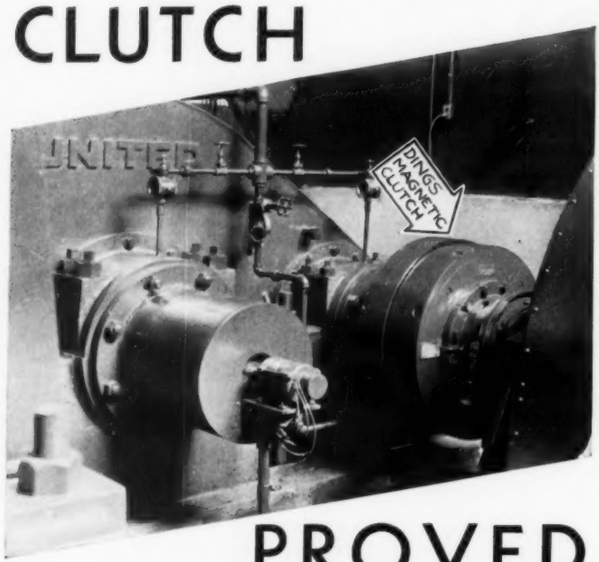
With this and other improved features of the latest type Farrel machines operators are able to cut roll grinding time as much as 50%, and at the same time obtain rolls with a perfect surface, free from marks of any kind, and with concave or convex contours ground to exact symmetry and accuracy.

Before installing any roll grinding machine we believe you will want to know why most of the machines bought this year have been Farrel.

FARREL-BIRMINGHAM
COMPANY, INC.

42 Main St., Ansonia, Conn.

A MAGNETIC CLUTCH



PROVED

in the Service of

LEADING STEEL MANUFACTURERS

WHO'S using Dings Magnetic Clutches? The outstanding firms in the steel industry—concerns that must buy with care.

The crippling of a clutch on a screw down means costly delay. Clutches in this service *must* be dependable.

It is significant then that such concerns as Republic Steel Co., Jones & Laughlin Steel Co., Carnegie Steel Co., Ford Motor Co., Detroit Steel Corporation, Sharon Steel Hoop Co., American Sheet and Tin Plate Co., Andrews Steel Co., and other equally well known firms have selected Dings Magnetic Clutches for the screw downs in their plants.

A complete line takes care of the problems of both single drive and double drive types and for problems involving end thrust. They are quick acting, embody a straight lift and assure perfect synchronization.

Where slippage problems occur a special type clutch is available with a serrated face and assures the transmission of full power.

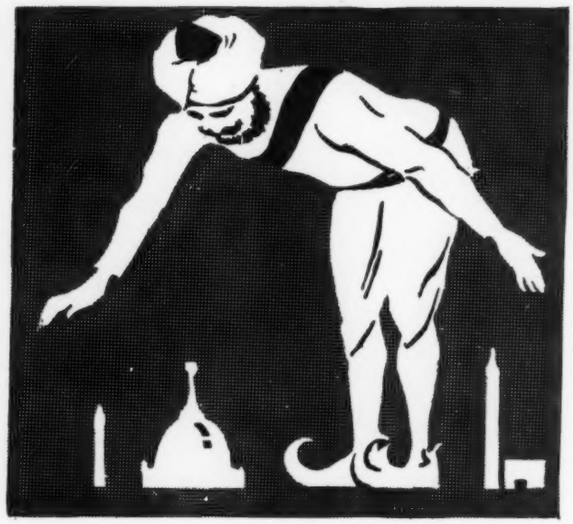
Don't specify clutches without finding out how Dings Engineers can help you. There is no obligation.

DINGS MAGNETIC SEPARATOR CO.

662 Smith Street — Milwaukee, Wisconsin

Dings *High Intensity* MAGNETIC CLUTCHES

EXPERIENCE THAT GOES BACK TO 1899



Attending the Iron and Steel Electrical Engineers Convention in Pittsburgh September 24th to 26th?

If so, be sure to visit our Booth ---No. 78.

You will meet the same crowd and receive the same friendly co-operation.

We have new grades of interest but will talk shop only if you care to.

Morganite Brush Co., Inc.

Alliance

"LARGEST BUILDERS OF THE WORLD'S LARGEST CRANES"

Booth 42

THE
ALLIANCE MACHINE COMPANY
Alliance, Ohio

DESIGNERS AND BUILDERS
OF
STANDARD CRANES · LADLE CRANES · GANTRY CRANES · SOAKING PIT CRANES · INGOT STRIPPERS · OPEN HEARTH, SLAB, AND BILLET CHARGING MACHINES · ORE AND COAL BRIDGES · CAR DUMPERS · ROLLING MILL MACHINERY · FORGING MANIPULATORS · DROP FORGE HAMMERS, STEAM AND BOARD · SPECIAL MACHINERY

BRUSH TROUBLES

Commutator Wear | *Rapid Brush Wear* | *Chattering Sparking* | *Heating Pitting*

"The Brush Phase of Motor Maintenance" is a simple yet scholarly explanation of how brushes affect motor and generator operation.

It is available without charge . . . no strings attached and if the knowledge obtained improves the efficiency of your equipment, we will be satisfied. *Send coupon today for your free copy.*

THE OHIO CARBON CO.
12508 Berea Road, Cleveland, O.

Please send copy of booklet "The Brush Phase of Motor Maintenance."

Name_____
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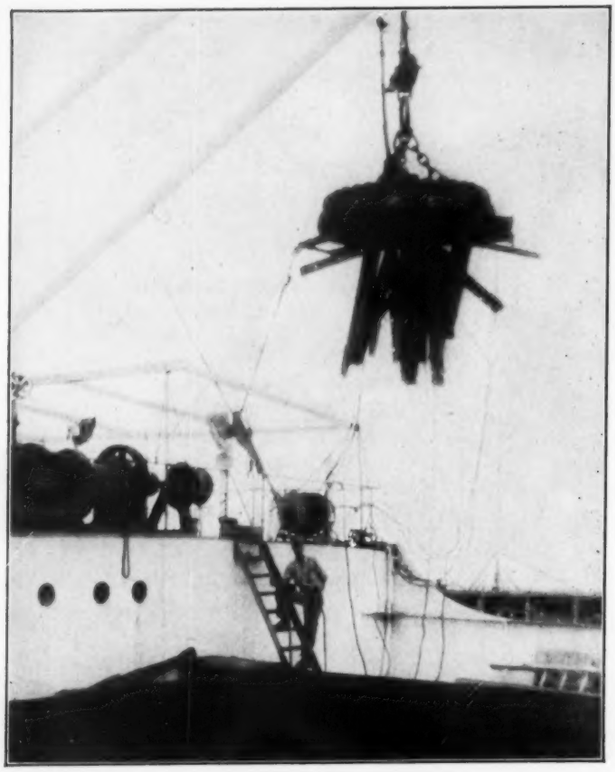
THE OHIO CARBON COMPANY · 12508 Berea Road · CLEVELAND, O.



Picture shows a 65" Ohio Magnet loading scrap on ship for Texas City Terminal Railway Company, at Houston, Texas

During one straight ten hour work period the crane and 65" Ohio Magnet transferred from open coal cars into ships hold 762 long tons averaging 76.2 tons per hour and 2450 lbs. each trip. The material consisted of old loose steel car wheels and steel car frames cut to approximately 3 foot lengths.

There was no "set up" [special preparation] whatever. The #1 scrap was loaded, as customary, in the interior, after the #2 was loaded and trimmed back in the wings, ready for the #1 which was to be discharged at the first Japanese Port. The cars were shoved in and unloaded as casually as any ordinary switch.

This is said to be a very good record.

Ask for Bulletin No. 109

THE OHIO ELECTRIC MFG. CO.
5907 Maurice Ave., Cleveland, Ohio

Savings Grow Larger When Volume Increases

There's increased activity throughout the whole iron and steel field and any product that can save money becomes an important aid to larger profits.

Every month sees more large steel mills using NON-FLUID OIL because their own tests furnish definite proof that it can save them money.

HOW? — Because NON-FLUID OIL does not drip or leak like liquid oil, so lasts from 3 to 5 times as long —saving money on oil cost.

Because it stays where applied, NON-FLUID OIL gives more dependable lubrication, reducing frictional wear and keeping down the cost of maintenance and repairs.

Check up by test right in your own plant. Write today for testing sample and full information.

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New York & New Jersey Lubricant Co.
Main Office: 292 Madison Ave., New York, N. Y.

WAREHOUSES:

Chicago, Ill.	Providence, R. I.	Atlanta, Ga.
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TRADE MARK REGISTERED
NON-FLUID OIL
IN U.S. PAT OFFICE & FOREIGN COUNTRIES

MODERN STEEL MILL LUBRICANT

Better Lubrication at Less Cost per Month

STIMPLE & WARD CO.

INCORPORATED

Manufacturers of Very High Grade Armature and Stator Coils In All Voltages

PITTSBURGH, PA.—SINCE 1898

SPECIAL EMERGENCY SERVICE

QUICK UNDERCUTTING WITHOUT REMOVING BRUSH ARMS

May be Used in Spaces only 2¼" wide

"Kuts" "U" or "V" Slots "Kwik"

Even high bus rings do not stop the Kut-Kwik Undercutter.

The Martindale Electric Co.
1377 Hird Street - - Lakewood
Cleveland, Ohio, U. S. A.

(See the Kut-Kwik Undercutter at our Exhibit Booth No. 35 Iron and Steel Convention.)

Announcing....

..*THE NEW* Martindale Kut-Kwik Undercutter

Driven by our new No. 5-TM4 oil-resisting, heavy duty, extra-flexible shaft which is connected to the Undercutter head by a threaded connection which eliminates vibration and chattering. The other end is connected to a ¼ h.p. 1750 r.p.m. motor or it can be furnished with a swivel connection for use with your motor. Equipped with a slot guide, depth gauge and handles mounted on double swivels, equivalent to a ball and socket joint, which permit setting the handles in any position.

Fill in and return coupon below for complete information.

THE MARTINDALE ELECTRIC CO.
1377 Hird St., Lakewood, CLEVELAND, OHIO

☐ Send me your new No. 19 Catalog.
☐ I'm interested in your New "Kut-Kwik" Undercutter.

Name and Title .....
Company .....
Street and No. .....
City and State .....

(9-35)

Hanger No. 96-R

Lower member—showing removable contacts

Contacts wired on to reflectors

FOUR Outstanding Improvements in the

THOMPSON Lamp Lowering HANGER

—greater ease and precision in operation—

—the iron latching parts, the wheel and the adaptor are Cadmium Plated for greater smoothness in operation and resistance to rust—

—removable lower contacts make reflectors interchangeable without rewiring—

—furnished with either one-piece or two-piece canopies—

—it is vastly superior to any THOMPSON HANGER you have ever had before—

—extremely useful in servicing overhead lamps—the Light will be more useful—because cleaner and brighter—when it does not have to fight its way through accumulated dirt.

●

Send for descriptive matter and prices.
Handled by leading electrical supply houses.

THE THOMPSON ELECTRIC CO.

1101 POWER AVE., N. E. CLEVELAND, O., U. S. A.

Hanger No. 211

Two-piece Canopy opened for cleaning

SPECIAL NOTE

IRON AND STEEL EXPOSITION

—•••—

Only Exhibitors and their duly accredited representatives

will be permitted to solicit business

and make commercial contacts on the floor of the

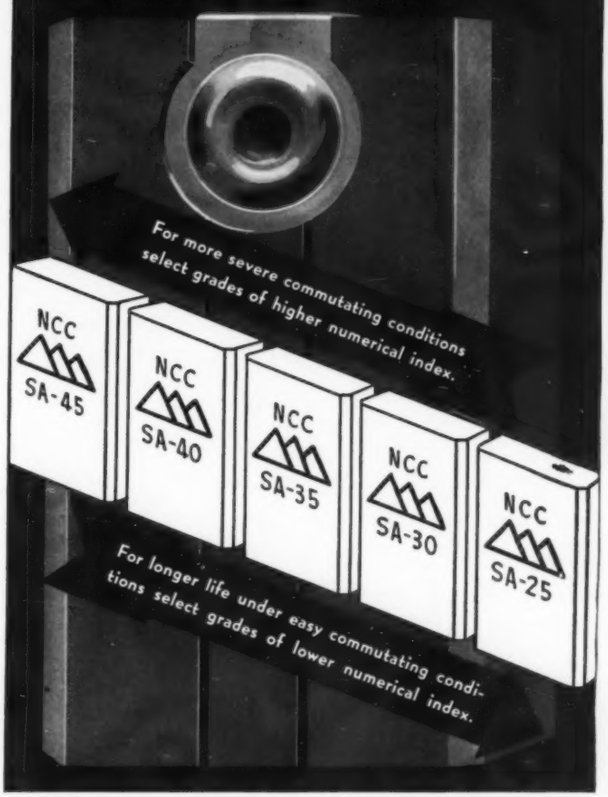
Iron and Steel Exposition

A NEW STANDARD OF UNIFORMITY

"SA" Series

ELECTRO-GRAPHITIC BRUSHES FOR HEAVY DUTY D. C. SERVICE

The grades of the "SA" Series are indexed primarily on the basis of commutating properties


For more severe commutating conditions select grades of higher numerical index.
NCC SA-45
NCC SA-40
NCC SA-35
NCC SA-30
NCC SA-25
For longer life under easy commutating conditions select grades of lower numerical index.

EVERY BRUSH THE SAME IN PHYSICAL PROPERTIES AND PERFORMANCE

Write for specific grade recommendation for your heavy duty D. C. service.

NATIONAL CARBON COMPANY, INC.
Carbon Sales Division, Cleveland, Ohio
Unit of Union Carbide UCC and Carbon Corporation
Branch Sales Offices: New York · Pittsburgh · Chicago · San Francisco

The new style 55″ Ohio Magnet lifting sheet steel punch press scrap. Practically all of its lifts are as good as the one illustrated.

All evidence is convincing that these new Ohio Magnets lift better than older models.

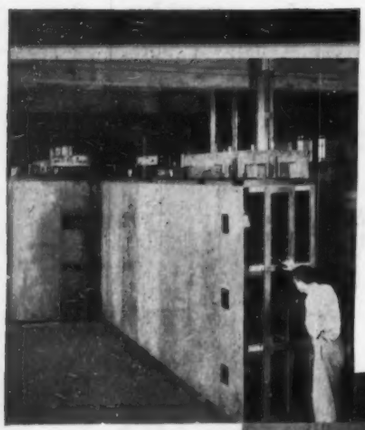
They also represent valuable improvements in mechanical details of construction.

▼

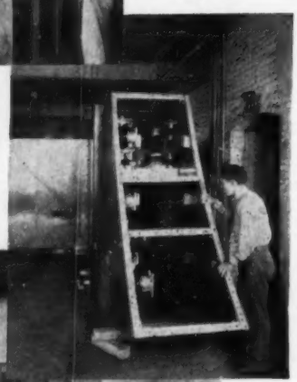
Ask for Bulletin No. 109

THE OHIO ELECTRIC MFG. CO.
5907 Maurice Ave., Cleveland, Ohio

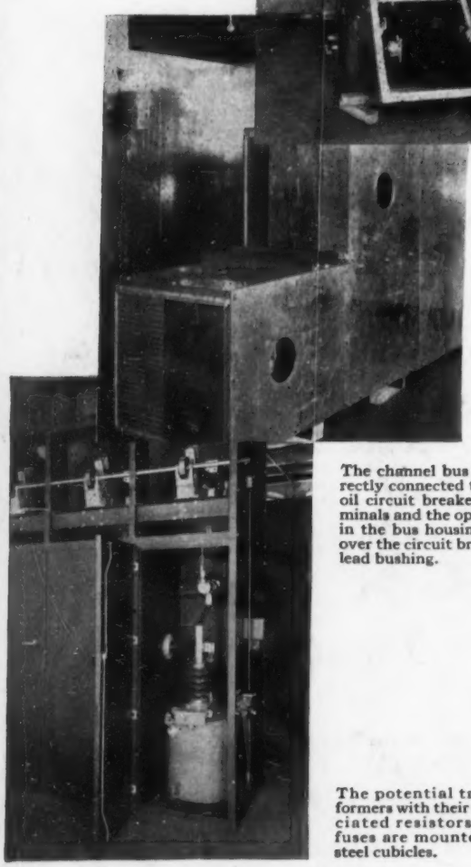
I-T-E AND . . .



Two 87500 KVA generators are parallelled and the delta primary connections of three 55000 KVA transformers are contained in this structure. Two such structures provide for the four generators and two transformer banks now being installed.

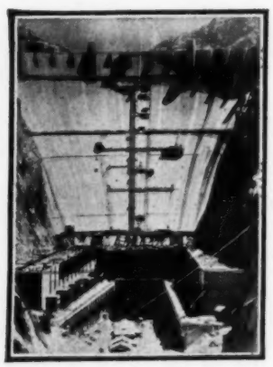


There are no cables in the main connections. The curved end of the bus structure bolts directly to the frame of one of the four generators.



The channel bus is directly connected to the oil circuit breaker terminals and the opening in the bus housing fits over the circuit breaker lead bushing.

The potential transformers with their associated resistors and fuses are mounted in steel cubicles.



METAL clad bus structures are not new to I-T-E. The fully enclosed air circuit breaker mounted in segregated steel compartment together with steel enclosed bus runs, was pioneered by I-T-E. It is only natural that this engineering experience should be used in producing the largest recent structure of this type—the 23 KV bus for the Boulder Dam Project.

New and novel construction details are many, but the "Story" in the 4000 ampere 23 KV bus for the Boulder Dam Project lies in the use of a factory fabricated structural bus from generators to transformers in place of the usual combination of bars, cables, supports, lugs, etc., assembled in the field.

Two six-inch copper channels mounted to form a hollow square conductor made up each phase of the three phase structure. Each conductor is individually enclosed in a housing formed by the sheet copper interphase barrier and the copper housing surrounding the entire structure. All points of contact on channel bus and connecting plates or flexible straps, are silver surfaced to prevent formation of high resistance oxides. Non-magnetic metals are used throughout that part of the structure enclosed in the copper housing.

Figures and photographs fail to impress anyone with the size and details of the bus job. Although the specifications were complete, certain performance clauses required the selection of proper materials for bus and housing. Manufacturing and assembly details included complicated mechanical and structural designs. The versatility of the I-T-E organization and the manufacturing facilities of the I-T-E Circuit Breaker Company are clearly indicated by the successful completion of this job.

•

A twelve-page illustrated story of the part I-T-E steel enclosed circuit breakers and bus played in a recent middle western steel mill will be sent on request. Ask for Bulletin No. 935.